PROCEEDINGS

of

THE FLORIDA STATE HORTICULTURAL SOCIETY *for*

1938

PUBLISHED BY THE SOCIETY

THE E. O. PAINTER PRINTING COMPANY, DELAND, FLORIDA

GARDENIA WALK, FLORIDA CYPRESS GARDENS, WINTER HAVEN

PROCEEDINGS

OF THE

FIFTY-FIRST ANNUAL MEETING

OF THE

Florida State Horticultural Society

HELD AT

WINTER HAVEN, FLORIDA
APRIL 12, 13 AND 14

1938

PUBLISHED BY THE SOCIETY
OFFICE OF PUBLICATION, DELAND, FLORIDA

Florida State Horticultural Society
Officers Elect for 1939

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Miami

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Orlando

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Eustis

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Krome Memorial Institute
Coconut Grove

DR. H. S. WOLFE
Krome Memorial Institute
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ASSISTANT SECRETARY

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FRANK L. HOLLAND, Winter Haven

EXECUTIVE COMMITTEE

EARL W. HARTT, Avon Park

C. D. KIME, Orlando

W. F. WARD, Brooksville

Constitution

Article 1. This organization shall be known as the Florida State Horticultural Society, and its object shall be the advancement of Horticulture.

Article 2. Any person or firm may become an annual member of the Society by subscribing to the Constitution and paying two dollars. Any person or firm may become a perennial member of the Society by subscribing to the Constitution and paying the annual dues for five or more years in advance. Any person or firm may become an annual sustaining member of the Society by subscribing to the Constitution and paying ten dollars. Any person may become a life member of the Society by subscribing to the Constitution and paying twenty-five dollars. Any person or firm may become a patron of the Society by subscribing to the Consstitution and paying one hundred dollars.

Article 3. Its officers shall consist of a President, three Vice-Presidents, Secretary, Treasurer and Executive Committee of three, who shall be elected by ballot at each annual meeting. These officers shall take their positions immediately following their election.

Article 4. The regular annual meeting of this Society shall be held on the second Tuesday in April, except when ordered by the Executive Committee.

Article 5. The duties of the President, Vice-Presidents, Secretary and Treasurer shall be such as usually devolve on these officers. The President, Secretary and Treasurer shall be ex-officio members of the Executive Committee.

Article 6. The Executive Committee shall have authority to act for the Society between annual meetings.

Article 7. The Constitution may be amended by vote of two-thirds of the members present.

Article 8. A section of the annual program of the Society shall be devoted to the discussion of sub-tropical fruits, exclusive of the commonly grown varieties of citrus fruits. This section shall be known as the *Krome Memorial Institute*. It shall be presided over by a fourth vice-president who shall be elected by ballot at each annual meeting by the members in attendance at the Institute. The fourth vice-president shall be an ex-officio member of the Executive Committee.

By-Laws

1. The Society year shall be co-extensive with the calendar year, and the annual dues of members shall be two dollars.

2. All bills authorized by the Society or its Executive Committee, for its legitimate expenses, shall be paid by the Secretary's draft on the Treasurer, O. K.'d by the President.

3. The meetings of the Society shall be devoted only to Horticultural topics, from scientific and practical standpoints, and the presiding officer shall rule out of order all motions, resolutions and discussions tending to commit this Society to partisan politics or mercantile ventures.

4. All patron and life membership dues and all donations, unless otherwise specified, shall be invested by the Treasurer in United States bonds. Only the interest on these bonds shall be available for payment of the current expenses of the Society. Perennial mmebership dues shall be placed on deposit at interest by the Treasurer. Only two dollars and the interest from each perennial membership fee shall be available for use in payment of current expenses of the Society during any particular year.

List of Members

HONORARY MEMBERS

Fairchild, Dr. David, Coconut Grove, Fla.
Haden, Mrs. Florence P., Coconut Grove, Fla.
Hume, H. Harold, Gainesville, Fla.
Lipsey, L. W., Blanton, Fla.
Rolfs, P. H., Vicosa, Minas Gacres, Brazil.
Shaw, Miss Eleanor G., Gainesville, Fla.
Stevens, H. B., DeLand, Fla. (Deceased.)

PATRON MEMBERS

COMPÁNIES

American Agricultural Chemical Co., Jacksonville, Fla.
American Fruit Growers, Inc., Orlando, Fla.
Angebilt Hotel, Orlando, Fla.
Armour Fertilizer Works, Jacksonville, Fla.
Buckeye Nurseries, Glen St. Mary, Fla.
Chase & Co., Orlando, Fla.
Coral Reef Nurseries Co., Homestead, Fla.
Deerfield Groves Co., Wabasso, Fla.
Deering, Chas.
Exchange Supply Co., Tampa, Fla.
Exotic Gardens, Miami, Fla.
Florida Citrus Exchange, Tampa, Fla.
Florida East Coast Hotel Co., St. Augustine, Fla.
Florida Grower Publishing Co., Tampa, Fla.
The Fruitlands Co., Lake Alfred, Fla.
Glen St. Mary Nurseries Co., Glen St. Mary, Fla.
Gulf Fertilizer Co., Tampa, Fla.
Hastings, H. G., Co., Atlanta, Ga.
Hillsboro Hotel, Tampa, Fla.
Klemm, A. M. & Sons, Winter Haven, Fla.
Lake Garfield Nurseries Co., Bartow, Fla.
Manatee Fruit Co., Palmetto, Fla.
Mills, The Florist, Jacksonville, Fla.
Nocatee Fruit Co., Nocatee, Fla.
Oklawaha Nurseries Co., Inc., Lake Jem, Fla.
Peninsular Chemical Co., Orlando, Fla.
Schnarr, J., & Co., Orlando, Fla.
Southern Crate Manufacturers Assn.
Thomas Advertising Service.
Van Fleet Co., Winter Haven, Fla.
Wilson & Toomer Fertilizer Co., Jacksonville, Fla.

INDIVIDUALS

Beach, John B., West Palm Beach, Fla. (Deceased.)
Gardner, F. C., Lake Alfred, Fla.
Hart, W. S., New Smyrna, Fla. (Deceased.)
Krome, W. J., Homestead, Fla. (Deceased.)
Rolfs, P. H., Vicosa, Minas Gaeres, Brazil.
Sampson, F. G., Boardman, Fla. (Deceased.)
Skinner, L. B., Dunedin, Fla. (Deceased.)
Taylor, John S., Largo, Fla. (Deceased.)

LIFE MEMBERS

Albertson Public Library, Orlando, Fla.
Allenbrand, Alfred, Box 228, Frostproof, Fla.
Alderman, A. D., Bartow, Fla.
Anderson, Frank K., Altamonte Springs, Fla.
Andrews, C. W., John Crerar Library, Chicago, Illinois.
Baltram, Francisco, Monterey, N. L., Mexico.
Barber, C. F., Macclenny, Fla.
Bartlum, W. Leonard, Fla. Agricultural Supply Co., Orlando, Fla.
Berger, E. W., Gainesville, Fla.
Berger, Mrs. E. W., Gainesville, Fla.
Bouis, Clarence G., P. O. Box 6, Ft. Meade, Fla.
Britt, John F., Ft. Pierce, Fla.
Carnegie, Mrs. T. M., Fernandina, Fla.
Champlain, A. E., R. F. D. No. 1, Palmetto, Fla.
Chase, Joshua C., Winter Park, Fla.
Chidester, D. D., 446 Painter Ave., Whittier, Cal.
Christiancy, Cornelius, Port Orange, Fla.
Clement, Waldo P., Georgaiana, Fla.
Conner, Wayne E., New Smyrna, Fla.
Cook, R. F., Leesburg, Fla.
Cornell, H. E., Winter Haven, Fla.
County Agricultural Agent, Orange County, Orlando, Fla.
Crutchfield & Woolfolk, Pa., Produce Building, Pittsburgh, Pa.
Drew, Prof. Wm. L., Eagle Lake, Fla.
Dunedin Public Library, Dunedin, Fla.
Ellsworth, W. J., Blanton, Fla.
Emerson, Geo. D., Coconut Grove, Fla.
Fairchild, Dr. David, Coconut Grove, Fla.
Fairchild, Mrs. David, Coconut Grove, Fla.
Fugazzi, John, care of Fugazzi Bros., Clearwater, Fla.
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Haden, Mrs. Florence P., Coconut Grove, Fla.
Hakes, L. A., P. O. Box 771, Orlando, Fla.

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Hernandez, Pedro M., 108 Cienfuegos, San Fernando, Cuba.
Hollingsworth, G. S., Arcadia, Fla.
Hume, H. Harold, Gainesville, Fla.
Iowa State College Library, Ames. Iowa.
Lassen, H. C., Bean Spray Pump Co., San Jose, California.
Lauman, G. N., Ithaca, N. Y.
Leonard, George V., Hastings, Fla.
Martin, A. Wm., Box 36, Sebastian, Fla.
McCarty, B. K., Eldred, Fla.
McCarty, Mrs. C. T., Eldred, Fla.
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Morley, John, Lake Alfred, Fla.
Moses, Wallace S., Palm Beach, Fla.
Mountain Lake Corporation, Lake Wales, Fla.
Myer, H. Van W., Coconut Grove, Fla.
Neville, H. O., Lonja Del Commercio, 542, Havana, Cuba.
O'Byrne, Frank M., Lake Wales, Fla.
Ohmer, C. J., West Palm Beach, Fla.
Olivebaum, J. E., Clermont, Fla.
Pennock, Henry S., Jupiter, Fla.
Phillips, Dr. P., & Sons, Orlando, Fla.
Pike, W. N., Blanton, Fla.
Plymouth Citrus Growers Assn., Plymouth, Fla.
Porcher, E. P., Cocoa, Fla.
Porcher, Mrs. E. P., Cocoa, Fla.
Prange, Mrs. Nettie M. G., Orlando, Fla.
Raulerson, J. Ed., Arcadia, Fla.
Reasoner, N. A., Oneco, Fla.
Reid, W. C., Largo, Fla.
Ricketson, Mrs. M. C., "Grayfield," Fernandina, Fla.
Rolfs, Prof. P. H., Vicosa, Minas Gaeres, Brazil.
Sample, J. W., Haines City, Fla.
Sandlin, A. R., Leesburg, Fla.
Schuman, Albert, Sebastian, Fla.
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Stevens, Edmund, Verge Alta, Porto Rico.
Strauss, J. E., Plant City, Fla.
Stuart, L. E., Montemorelos, Mexico.
Taylor, J. S., Jr., Largo, Fla.
Thomas, Jefferson, Gainesville, Fla.
Towns, Thomas R., Holguin, Cuba.
Trelease, Wm., University of Illinois, Urbana, Ill.
Trueman, R. B., Jacksonville, Fla.
Wirt, E. L., Box 144, Babson Park.
Yothers, W. W., Orlando, Fla.

CONTINUING MEMBERS

Cleveland Public Library, 325 Superior Ave., N. E., Cleveland, Ohio.
Library Citrus Experiment Station, Riverside, California.
Library Univ. of Cal. at Los Angeles, Los Angeles, California.
Library, Florida Agricultural Experiment Station, Gainesville, Fla.
Library, U. S. Department of Agriculture, Washington, D. C.
Library, University of California, Berkeley, California.

PERENNIAL MEMBERS

Atwood Grapefruit Co., Manavista, Fla. 1936-40.
Aycrigg, Geo. B., Winter Haven, Fla. 1935-39.
Billings, H. G., Lowell, Fla. 1934-38.
Daetwyler, M. J., Orlando, Fla. 1935-39.
Floyd, Maj. W. L., University of Florida, Gainesville, Fla. 1936-40.
Geier, P. A., 540 E. 105th St., Cleveland, Ohio. 1934-38.
Greenamyer, A. G., 302 Highland Ave., Buffalo, N. Y. 1935-39.
Holtsberg, Fred, Ft. Pierce, Fla. 1936-40.
International Fruit Corp., Winter Haven. 1936-40.
Jacocks, A. J., Winter Haven, Fla. 1936-40.
Keenan Soil Laboratory, Frostproof, Fla. 1936-40.
Maher, W. J., Maher's Dept. Store, Vero Beach, Fla. 1936-40.
Manatee Hammock Fruit Company, Manatee, Fla. 1938-42.
Meyer, Carl, 2144 Slane Ave, Norwood, Ohio. 1935-39.
Robinson, T. Ralph, Box 1058, Orlando, Fla. 1936-40.
Stone Farm Association, 90 Broad Street, New York City. 1936-40.
Wilson & Toomer Fertilizer Co., Jacksonville, Fla. 1935-39.
Woltz, James M., 363 Lora Ave., Youngstown, Ohio. 1937-38.

SUSTAINING MEMBERSHIPS—ANNUAL

Brooks, Chas. I., 2272 S. W. 11th Terrace, Miami, Fla.

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ANNUAL MEMBERS IN THE STATE
1938

Abbott, Prof. Chas. E., University of Florida, Gainesville, Fla.
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Edsall, R. S., Wabasso, Fla.
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Florida Citrus Exchange, Tampa, Fla.
Florence Citrus Growers Ass'n, Florence Villa, Fla.
Florida Dolomite Company, Pembroke, Fla.
Florida Foods Journal, Orlando, Fla.
Florida-gold Citrus Corp'n, Lake Alfred, Fla.
Florida Grower Magazine, Tampa, Fla.
Frasse, Wm. H.., Box 134, Coral Gables, Miami, Fla.
Freeman, R. E., Fla. Citrus Canners Cooperative, Lake Wales, Fla.
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Frisbie, S. Lloyd, Bartow, Fla.
Fudge, B. R., Lake Alfred, Fla.
Fuller, Wm. Allison, Box 176, Cocoa, Fla.
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Gardner, Mrs. F. C., Lake Alfred, Fla.
Garnett, Irl B., Hypoluxo, Fla.
Garrett, Chas. A., Kissimmee, Fla.
Gibbons, G. H., Waverly, Fla.
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Gocio, H. G., Sarasota, Fla.
Gocio, H. G., Jr., Sarasota, Fla.
Goodwin, J. C., Gainesville, Fla.
Gary, W. Y., Dept. of Agriculture, Tallahassee, Fla.
Granger, John, Marianna, Fla.
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Graves, Forrest C., Box 606, Vero Beach, Fla.
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Graves, Ted, Cocoa, Fla.
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Gulf Fertilizer Company, Tampa, Fla.
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Hawkins, H. E. C., c/o Fla. East Coast Ry., St. Augustine, Fla.
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Hunt, C. M., Lake Wales, Fla.
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Jackson Grain Company, Tampa, Fla.
Jackson, R. D., Tampa, Fla.
Jahr, Henry, Brooksville, Fla.
Jefferies, John H., Lake Alfred, Fla.
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Jones, Minor S., Winter Haven, Fla.
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Keown, Miss Mary E., State Home Demonstration Agent, Tallahassee, Fla.
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King, Batty, Box 44, Estero, Fla.
Kinney, Mrs. W. C., Waverly, Fla.
Kirkland, L.. P., Auburndale, Fla.
Kirkland, W. H., Auburndale, Fla.
Klemm, A. M., & Son, Winter Haven, Fla.
Klingensmith, Jas. L., Route 1, Vero Beach, Fla.
Knight & Wall Company, Tampa, Fla.
Knight, J. M., Box 814, Vero Beach, Fla.
Knight, Peter O., Tampa, Fla.
Knox, L. B., Ormond Beach, Fla.
Koblegard, Ruhl W., Ft. Pierce, Fla.
Kosel, Geo. W., Route 1, Box 161, Redland, Fla.
Krome, William H., Homestead, Fla.
Krome, Mrs. William J., Homestead, Fla.
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Kuntz, Wm. A., Lake Alfred, Fla.
Lafferty, E. J., Pierce, Fla.
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Larsson, Jonas, Route 1, Box 41, Apopka, Fla.
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Lathers, Chas., Winter Haven, Fla.
Laughlin, V. H., Winter Haven, Fla.
Law, Percy E., c/o Mapes Formula & Guano Co., Jacksonville, Fla.
Lawless, W. W., Lake Alfred, Fla.
Leach, Robert, Route 1, Largo, Fla.
Leslie, John T., Haines City, Fla.
Lewis, H. F., Terra Ceia, Fla.
Link, Mrs. Cora Eileen, Ft. Lauderdale, Fla.
Lipscomb, S. F., Bartow, Fla.
Lipsey, O. W., Dade City, Fla.
Lobdell, R. N., Belle Glade, Fla.
Lockett, L. D., Cocoa, Fla.
Lockett, N. A., Winter Garden, Fla.
Logan, John H., Largo, Fla.
Loomis, Burdett, Jr., Pierce, Fla.
Lord, E. L., Box 1948, Orlando, Fla.
Loucks, Kenneth W., Leesburg, Fla.
Loudon, Hugh R., Babson Park, Fla.
Loudon, Jas. S., Lake Wales, Fla.
Lyle, Miss J. P., San Mateo, Fla.
Lyons Fertilizer Co., Tampa, Fla.
McCabe, P., San Antonio, Fla.
McKinnon, W. M., Sanford, Fla.
McLain, L. Rogers, c/o Gulf Fert. Co., Tampa, Fla.
McPeck, John K., 416 Maple Ave., Sebring, Fla.
Mabson, H. B., Winter Haven, Fla.
MacKenzie, K. A., Auburndale, Fla.
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1938

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PROCEEDINGS

OF THE

FLORIDA STATE HORTICULTURAL SOCIETY

VOL. LI PRINTED 1938

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Fifty-First Annual Meeting of the Florida State Horticultural Society

The Fifty-first Annual Meeting of the Florida State Horticultural Society was held in Winter Haven, Florida, on April 12, 13 and 14, 1938. The meeting opened at 8:00 P. M. on Tuesday, April 12, and continued through the closing session of Thursday night, April 14. On Wednesday evening, April 13, the Society held a combined session with the Krome Memorial Institute, that being the Sixth Annual Meeting of the Institute. The complete Proceedings of that meeting are included in this volume.

The meetings of the Society and of the Institute were held in the Civic League Building and the Society is indebted to the Winter Haven Chamber of Commerce for providing the building for its use. The headquarters for the Society and the Institute was the Haven Hotel and the Society is indebted to the owner, Mr. George Andrews, for the many courtesies extended and the liberal use of the hotel facilities.

Florida Rose Society

The Florida Rose Society held its Thirteenth Annual Meeting and Rose Show on the mezzanine floor of the Hotel Haven. The meeting was well attended and very active interest was shown.

The *Rose Show* was sponsored by the Winter Haven Garden Club and the Gardenia Garden Club of Winter Haven, and was directed by Mrs. Leo Nash and Mrs. Donald McDonald, who were the presidents of the respective Clubs. In connection with the Show, a display of Florida grown Gladioli was arranged that proved to be an outstanding feature. The staging of the Show entailed days of work and worry for the ladies of the two Clubs, and much credit and praise is due them for the attractiveness and excellence of the Show. Thanks are due the Bessemer Properties of Port Mayaca, the Pinellas Gladiolus, Inc., of Clearwater, and the Leesburg Bulb and Flower Company of Leesburg for supplying the Glads for the Show.

Thanks to All

No meeting of the Society is held without some real hard work on the part of a number of individuals who volunteer their services and receive little credit except the satisfaction of a piece of work well done. The Winter Haven Meeting was no exception. So many took part and contributed in many ways to the success of the meeting that mention cannot be made of all. To those people, we express our sincere thanks. Included in this big group were the Members of the Chamber of Commerce of Winter Haven, led by its genial President, Mr. E. B. Walthall; the ladies of the Winter Haven Garden Club and the Gardenia Garden Club of Winter Haven; Mrs. Leo Nash, Mrs. Donald McDonald, Mr. and Mrs. Frank Holland, Mr. Jack Fuller and Mr. K. E. Bragdon of Winter Haven; Mr. F. M. O'Byrne of Lake Wales and Mr. C. D. Kime of Orlando.

Our Speakers

We were pleased to have with us as the speakers at the opening session, our good friends, the Hon. Nathan Mayo, Commissioner of Agriculture of Florida, the Assistant Commissioner, Mr. J. T. Brooks of Tallahassee, and Judge Spessard L. Holland of Bartow. On Thursday afternoon, Dean Walter J. Matherly of the University of Florida at Gainesville opened the Symposium on the Marketing of the Citrus Crop with a masterly talk on the Inter-Relationship of Business and Industry. To these, and to some thirty other speakers, who took part in the programs, we express our deep appreciation.

Visits and Entertainment

On Wednesday afternoon the members of the Society were the guests of the staff of the Citrus Experiment Station at Lake Alfred. Under the leadership of its Director, Dr. A. F. Camp, and his associates, visual demonstration

was given the members of the effects of the various mineral deficiencies and of disease and pest control, in citrus through a visit to the plots where some of their work is being carried on. These demonstrations were very impressive and educational, and much credit is due these workers for the outstanding work they are doing for the benefit of the Citrus Industry in Florida. It is to be hoped that they will be able to continue and extend their work, unhampered by any lack of personnel or facilities.

During the same period, the Florida Rose Society conducted a pilgrimage to the Rose Gardens of Mr. and Mrs. Nye Jordan at Bartow. The extensive rose plantings and the landscaping were viewed with active interest by the members and provoked many questions and discussions.

Later in the afternoon, the two groups converged at the famous Cypress Gardens, where they were the guests of Dick Pope and his associates, at the Third Annual Gardenia Festival. Previous to and following the Festival, the members wandered through the grounds viewing with amazement the extensiveness and the variety of the plantings, the beautiful vistas, and the excellent condition of the plants. That they were dumfounded was indicated by the statement of a workman that he was amazed at the ignorance shown by the questions asked. Perhaps he expected too much of our horticulturists. Anyhow it is one of the outstanding beauty spots in the state and we suggest that those who have not seen it, should see it at their earliest opportunity, and to those who have seen it, we suggest repeated visits as its beauty changes with the seasons, and those who enjoy landscape beauty will always find something new to repay them.

For those who like water sports, Mr. Pope staged a series of speed boat events that were thriiling and impressive. The Third Annual Gardenia Festival was a program of dancing and music, built around a Gardenia theme and carried out in a most impressive manner in an outdoor setting by a talented group of boys and beautiful girls in costume. It was the outstanding event of the afternoon and a thoroughly enjoyable one that was well worth seeing.

Programs

There were many Oh's and Ah's as the members were handed their official programs of the meetings. The reason was the beautiful colored covers showing a view of Gardenia Time in Florida Cypress Gardens on the front cover and a map showing the location of Colorful Florida's Most Colorful Spots, on the back cover. These covers were donated by Mr. Dick Pope of the Florida Cypress Gardens.

Attendance Cup

The attendance at the Fifty-first Annual Meeting of the Society was better than usual, filling the Civic League Building to capacity. The attendance cup, given by the McKee Jungle Gardens at Vero Beach, was won by Orlando and with fitting ceremony was presented to Mr. C. D. Kime, who represented the Chamber of Commerce of Orlando.

New Officers

It is with regret that we announce the resignation of our Treasurer of many years' standing, Mr. Norman A. Reasoner. Mr. Frank Holland of Winter Haven was elected to succeed him. New members on the Executive Committee are Mr. Earl W. Hartt of Avon Park and Mr. C. D. Kime of Orlando. Mr. F. M. O'Byrne of Lake Wales was started on the way to the Presidency by election as a Vice-President.

The new officers in the Florida Rose Society are G. H. Blackmon, Gainesville, President; Mrs. Leo Nash, Winter Haven, Vice-President; Mrs. Donald McDonald, Winter Haven, Secretary; Mrs. D. E. Cole, Lake Wales, Treasurer.

Necrology

The report of the Necrology Committee is included in this volume. The Secretary regrets to announce the passing of Mr. H. B. Stevens of DeLand, Mr. John F. May of Winter Haven and Dr. R. M. Barnette of the Experiment Station, Gainesville, since the Winter Haven Meeting. Proper obituaries will be included in the 1939 Proceedings.

PROCEEDINGS

OF THE

Florida State Horticultural Society

FIFTY-FIRST ANNUAL MEETING

WINTER HAVEN, APRIL 12, 13 AND 14, 1938

OPENING SESSION

President C. I. Brooks: This, the Fifty-First Annual Meeting of the Florida State Horticultural Society, will now come to order. I welcome you to this First Session, convened at 8:00 P. M. on Tuesday, April 12, 1938. Rev. Harcourt Johnson of Winter Haven will tender us the Invocation.

INVOCATION

REV. HARCOURT JOHNSON
Winter Haven

President Brooks: In the absence of Mayor A. M. Hess, who found it impossible to be with us this evening, our Address of Welcome will be delivered by the Hon. Henry M. Sinclair, of this city.

ADDRESS OF WELCOME

HON. HENRY M. SINCLAIR
Winter Haven

Mr. Chairman, Members of the Florida State Horticultural Society and Friends of Horticulture: I am pinch-hitting for Mayor Hess, who sends his sincere regrets in being unable to be here and welcome you to Winter Haven this evening. I feel this is a very fitting place for holding a meeting such as this, since we are in the center of the citrus-producing area of the State and I believe that to be a No. 1 item in horticulture.

Anything the City of Winter Haven can do for you while you are in town, call on us. We want you to feel at home and welcome you one hundred per cent in every sense of the word. Thank you for this opportunity of welcoming you here to my city. (Applause.)

Mr. Brooks: Thank you, Mr. Sinclair. I feel Mayor Hess sent a very worthy representative to welcome us to Winter Haven.

We will now listen to the Response to the Address of Welcome, by E. L. Wirt, of Babson Park.

RESPONSE TO THE ADDRESS OF WELCOME

E. L. WIRT
Babson Park

Mr. President, Mr. Sinclair, Ladies and Gentlemen:

On behalf of the membership of the Florida State Horticultural Society I am pleased to acknowledge the welcome offered us by Mr. Sinclair.

Last year at Ocala, Mr. Spangler and his associates from your city pictured in glowing colors the advantages of your fair city and community and the welcome we would receive if we would accept your urgent invitation to hold our 1938 meeting here. For the benefit of Mr, Sinclair and his fellow citizens maybe he should be interested in knowing whom he has welcomed so heartily.

One of our members under similar circumstances has facetiously referred to our citrus-grower membership as a bunch of gamblers—gambling with the elements, insects, plant diseases, politicians, transportation companies, markets and what have you. Others in a more serious vein have pictured as representative of our membership that sturdy group who nursed our Society in its infancy, guided it through the storms that beset the industry through the following years, and whose survivors still are largely instrumental in formulating the sound policies of the Society that enable it to serve its membership more efficiently.

Now I want tonight to picture the membership of the Florida State Horticultural Society as an earnest, sincere group of men and women, principally engaged in the production and marketing of citrus and other sub-tropical and tropical fruits and ornamentals, seeking how they may improve the quality of those products, how they may reduce the cost of such production and how they may be marketed with some profit.

So these serious minded men and women are gathered to learn from Dr. A. F. Camp and his associates of the Citrus Experiment Station as well as from others experienced in the production and marketing of these horticultural products those things that will enable them to produce better fruit and sell it to better advantage. Since "all work and no play makes Jack a dull boy" we will enjoy and appreciate those features of the program that are essentially entertaining. And yet I see in those features more than mere entertainment. I foresee a great interest in the many unusual plants that we will see in your Cypress Gardens. We are sure we shall enjoy our visit to your community, long and intimately connected with all phases of the citrus industry, its production, marketing, by-products, and research.

Mr. Sinclair, we thank you and your city for your cordial words of welcome.

Chairman: We will now introduce our oldest member:

INTRODUCTION OF OLDEST MEMBER

C. I. BROOKS

I will ask Mr. L. W. Lipsey of Dade City to stand. (Mr. Lipsey stands.) Mr. Lipsey is the only living original member of the State Horticultural Society, living and joining at the time of its organization. (Hearty applause.)

PRESIDENT'S ANNUAL ADDRESS

C. I. BROOKS
Miami

Ladies and gentlemen, our program calls for an address, but I am just going to make a few short remarks tonight. Having been elected to fill Joe Lyons' term of office, he passing away so suddenly, puts a burden on me that I feel regret in having to accept. We all loved Joe Lyons and I feel no one can step into his shoes and take his place. Our President, C. W. Lyons, was cut down in the flower of manhood while still vigorous and active and loved by us all. Still, we must "carry on" and do the best we can. We have a heavy program for this evening, and so I am going to conclude my remarks.

The next item on the program is an address by a man whom I don't need to introduce to you, he is so well known and, therefore, I will simply present at this time the Honorable Nathan Mayo, Commissioner of Agriculture,, Tallahassee.

ADDRESS

HON. NATHAN MAYO
Tallahassee

Mr. President, Ladies and Gentlemen: I assure you this is a great pleasure. I have met with the Horticultural Society on several occasions and had delightful times. I am sure we will have just as good a time here. I am here tonight by chance. When I received this invitation I did not think it would be possible for me to attend and I had assigned a very able and efficient assistant, Mr. T. J. Brooks, to make the talk here tonight which he will give a little later. So I have no prepared address.

I have been down to the southern part of the state, visiting various state markets and understood the meeting started yesterday and tonight we would have a banquet, so I said to my wife, we are only about fifty miles from Winter Haven. let's go over and take supper with them, so I haven't had any supper yet.

I am going to talk in a rambling way about just a few things that are going on in the state. You know we have gathered here at this Horticultural meeting for the best interests of agriculture and horticulture. We are here to discuss various problems and I am reminded now, by the disastrous season we have just gone through, of a story I once heard about a man who said—show me a child and I'll show you who that child's father was. So first they showed him a child eating candy and he said his father must be a merchant, the child has plenty of candy, and that was right. Next they showed him another child reading a book and he said I imagine that child's father was a school teacher and that was correct. Then they showed him a little tot trying to put his foot in his mouth. Why, that is the easiest guess of all, said the man, his daddy is a farmer, he's been trying all his life to make both ends meet. (Laughter, applause.)

I want to talk to you about a few things that perhaps Mr. Brooks has not listed. One thing is the disastrously low prices we have received for our citrus this season. Various things caused that. One of the main things that brought low prices was California's crop, Texas' crop and Florida's crop coming right in together with one of the largest apple crops in history. Perhaps, too, the way we are disorganized had something

to do with the low prices. In Dade County the latter part of last week they tell me their celery crop met disaster, and last Friday cucumbers were selling from 90c to 95c, the finest I ever saw and this season should bring $3.00 to $3.50 a crate, so it looks as if we are in for a lean year. I do believe we can correct some of these evils here at home and be better organized on our citrus program than in the past. How we are going to do this I don't know, or what to suggest. California handled about 85% of this season's crop and the others in that state 15%—and they have only two varieties, Valencias and Navels.

On the other hand we have over 400 different shipping organizations and that is one of the things we are up against. I believe also we can tighten up on materials and right now I want to affirm, as I did a few weeks ago in the press, that the arsenic law will be enforced to the letter. (Applause.)

I also want to call your attention to the various state farmers' markets—some are fruit and vegetable markets, some live stock markets—we have started these on a shoe string, you might say, on whatever we can get from Santa Claus in Washington, whatever the local community that wants one of these markets will put in and what little funds the Department of Agriculture has. We are operating, so far, the Ocala Fruit and Vegetable and General Farmers Market, together with a live stock market; the East Palatka General Farmers Market to take care of the cabbage crop in that territory; the Sanford market is now operating in its third year very successfully and at a cost of less than 3%. We ask no profits on these markets, we just want sufficient to cover operating. The Wauchula and Palmetto markets are fruit and vegetable. The Bushnell market opened yesterday, it is also vegetable. In Live Oak the tobacco warehouse is used during the tobacco season only six weeks of the year and the balance of the time is a general farmers' market. Tallahassee has a live stock market, Chipley a creamery and egg market that produced last month over 17,000 pounds of butter. This is used partly in the State Institutions and some by the general public. We are constructing a general farmers' market in Pensacola, also a fruit and vegetable market is under construction in Plant City and at Starke, a project has been approved and we hope to get started in the next few weeks. It will be a fruit and vegetable market, then one at either Belle Glade or Pahokee, cattle markets at Arcadia and Labelle.

The dairy business has advanced—some five years ago we were shipping quite a bit of milk into the state and today a little milk is being shipped out. The poultry industry is growing by leaps and bounds.

I have taken up all the time I feel like taking this evening. Mr. T. J. Brooks is going to talk to you and I thank you for this occasion to be with you. (Applause.)

Chairman: Mr. Mayo, I am sure we thank you very much for that enlightening address, it has given us a great deal of information we all wanted to hear and we hope we will be able to benefit from a continuance of your administration. (Loud applause.)

Our next speaker is the Honorable T. J. Brooks, Assistant Commissioner of Agriculture, Tallahassee. Mr. Brooks:

CROPS FOR FUTURE INCREASE IN PRODUCTION

HON. T. J. BROOKS
Assistant Commissioner of Agriculture

As the word Horticulture includes all manner of crops grown on the farm it is a very inclusive subject. Of course the most of you are primarily interested in the crops that you are now growing and only academically interested in the things that might be grown. Thinking that perhaps this is a somewhat neglected field I have chosen as my theme, "Crops for Future Increase in Production."

Take a few of our esculent crops: Sweet potatoes will grow almost everywhere in Florida. They are a universally used food. A great per cent of them rot every year. There are other uses for this crop than eating them. There is a factory now operating in Mississippi where 420,000 pounds of starch are made annually from sweet potatoes. They can also be dehydrated and used.

The cassava is grown in this state and used for hog feed. Mixed with other feed it is a worthwhile crop. But it is also used for human food. Many people in South America eat bread made from the cassava. It is also useful for making tapioca and tons of it are imported for this purpose. There is another use for which there is a tremendous demand. It makes a good glue and the United States Government uses many tons of glue on the back of postage stamps. Why do we not grow more cassava and supply factories without importing from other lands?

The artichoke is a root crop that can be grown in about as many countries and on as many different kinds of soil as any crop. The Federal Bureau of Home Economics says it is similar in food value to the white potato. Every part of the plant has its use either as human food, stock food, forage or for manufactured articles. The stems and leaves can be used as forage. It can be used to smother out obnoxious weeds and grasses. The tubers make a better quality of alcohol than beets. As a food the artichoke can be used baked, boiled, fried, in casserole, in salad, in soup or puree.

It has been demonstrated that two hundred different kinds of fruit can be grown in the extreme southern part of the state. As to how many of them can be made to yield in commercial quantities and on a paying basis is yet to be seen. No doubt many of them can be developed to profitable food-producing crops. We are now producing on a commercial scale Papayas, Avocados, Mangos, Guavas and other tropical fruits.

There is room for a large increase in the production of tung oil in this state. It is one thing we can increase without fear of overproduction. It will require hundreds of thousands of acres of tung groves to supply the demand in the United States for tung oil. It is a promising source of revenue to hundreds of growers in the near future.

One of the sure things for Florida is the return of long staple cotton. It is the only kind of cotton that can compete with foreign cottons of all kinds and with other fiber-bearing plants. So long as we can keep the boll weevil out of it there is profit in growing cotton at 20c to 30c per pound. Our only trouble at present is in making enough to attract the big buyers of long staple lint. It is another crop that we cannot grow an over supply. We produced 3,000 bales last year.

Florida is just beginning to demonstrate how well cultivated pastures can be provided for cattle and as a result the cattle industry is forging ahead rapidly. We have an all-year-round grazing climate and the task before us is to have an all-year-around growing pasture. More should be done along this line.

NEW CROPS

There are old crops in other countries and other parts of the United States but which are new to Florida in a commercial sense. We should at least test out a lot of new crops and if found adapted to this state we certainly should launch into their production on a large scale. The grow-

ing of some crops depends entirely on the facility with which they can be handled and prepared for the market. The process of manufacturing some articles determines the feasibility of growing them. Competitive markets are an important part of the problem of determining the advisability of plunging into a new field of agricultural production. This fact is true of all kinds of business.

Food, clothing and shelter are said to be the prime necessities of man. The question of food and clothing is essentially agricultural. Shelter is all inclusive as to a place to live. There are certain crops that furnish the raw materials for all manner of clothing. Originally the skins of animals and certain crude kinds of fiber garments were used as clothing. In quite early times, even the very ancient peoples began the use of various kinds of fiber which were woven by hand in primitive machines. Later complicated machines were invented which handle silk, cotton, hemp, flax, ramie, etc.

For ages, all fibers were prepared for weaving by hand. Cotton fiber had to be picked from the seed by hand; silk was handled by an elaborate and expensive process; flax, hemp and ramie were plants whose fibers were in the stalk and not in a boll or produced by a worm. The slow, tedious processes of obtaining the fibers from stalks made them poor competitors with cotton as soon as cotton gins were invented. This crop could be produced in greater amounts and of better quality in the southern part of the United States than elsewhere until the American cotton dominated the cotton markets of the world.

Now that other countries are growing it in large quantities and with cheaper labor than we have had since ante bellum days "king cotton" no longer rules from the U. S. throne. Egypt, Central Africa, India, Brazil, Paraguay and Argentine are strong competitors.

It has been demonstrated that ramie will grow well in Florida. If, and when, a machine or a process or a combination of the two is invented that will efficiently and economically separate the fiber from the stalk without damaging the fiber it will enter the textile field as a strong competitor of cotton, flax, hemp, wool, silk and rayon. It is now claimed by several inventors that this feat has been accomplished, but as yet we lack satisfactory commercial demonstration to justify a final conclusion. We have the first commercial ramie factory in Florida which takes the raw ramie and prepares it for the loom, or for paper mills. If we are to hold our own in the fiber market it will be in the utilization of other fibers than short staple cotton. Any attempt to peg the price of short staple cotton will pyramid surpluses and defeat the purpose in the end. The price of raw fibers is set in world markets and we cannot peg prices except at home nor can we reduce acreages in foreign lands. Ramie can be produced at less than half the cost of cotton and the fiber can be had of any desired length; its durability far exceeds that of cotton and can be put to almost any use that cotton is used for. It is potentially a future crop for Florida.

Other fiber-bearing plants have been experimented with and are thought to have possibilities as commercial crops if methods of handling could be devised that would master the problem of getting it ready for the looms economically and in proper condition. Among these we may mention sansevieria and cotine. Nothing definite has been done in the way of commercializing these plants.

Florida has a wide range of native plants that have a specific use. One classification of these plants is under the head of drug plants. Dr. B. V. Christensen of the State University has done much in locating and disseminating knowledge on this subject. There is an immense demand for certain drug plants and many of them grow wild in this state and many can be cultivated and a regular trade can be established with the big drug manufacturers and compounders of the country. This field of agricultural production is practically untouched. There is already a fairly good trade on wild deer tongue. It is only one of the many plants that show commercial possibilities.

Chemurgic science is discovering new uses for many crops. This will tend to take care of surpluses. It will also open markets for crops hitherto thought to be of very limited value. The peanut crop has gone far beyond the volume that was grown a few years ago. Its many uses have stimulated the demand. Soy beans is an-

other example. Corn, cotton seed, sweet and white potatoes are also included.

Some European countries are ransacking the uttermost parts of the earth to find plants which they can import and grow somewhere in their possessions. Florida has imported the major part of the fruits and vegetables which she now grows, both for home use and for the world markets. More of this can be done.

Conservation is not outside the scope of the study of the farmer, no matter what kind of farming he may be doing. The Federal Government is taking an active part in the conservation of all resources. The tremendous waste that has been allowed in the recent past is really alarming. The methods of conservation are, in the main, proper handling of soils from the following angles: Erosion, improvement of crops, maintaining crops, farm engineering; other branches of agricultural conservation are destruction of pestiferous insects, weeds, and grasses, favoring insectivorous birds and animals, adapting crops to soils, conserving moisture, drainage and irrigation.

There is a direct relationship between soil and civilization. Chemistry first revolutionized metallurgy, physics, cooking, medicine and the plastic arts. It is now helping to guide the farmer in the management of the soils. Bio-chemistry includes health, culture, and wholesome living. A new problem is looming up and challenging man for mastery: The dependence of human longevity on soil content.

The human organism can live without some of the elements which it needs. In this case, however, there is less power of resistance to disease than there would be if all the minerals and vitamins are in the foods which the human organism needs. The vegetables and meats which furnish the foods of mankind must have these elements or the human organs are deprived of essentials. Each vegetable, fruit and meat that is edible is supposed to have in it certain elements but they, like the human body, will live without some of these essentials. This being so, one may eat good food, well prepared, and still be slowly starving for want of certain minerals or vitamins. Even stockmen are feeding cattle prepared minerals to supplement the regular feeds that are given livestock and getting spplendid results.

With these facts brought home to the public the manufacturers of commercial fertilizers are advertising formulas that contain the regular nitrogen, phosphorus and potash and many other minerals which should be in the plants that are to be grown for foods and feeds. All soils do not have some of the essentials other than the three that have been depended on for all crops.

It is also true that the human organism can live with ingredients in it that should not be in it. There is no need for nicotine but the system can accommodate itself to it to a degree that a buzzard will not eat the carcass of one heavily charged with it. The human system does not need an overdose of alcohol or morphine but it will live with a considerable amount of either one in it.

The problem to solve is to have a balanced soil, to get a balanced crop, to have a balanced food for man and a balanced feed for stock. If this were worked out perfectly, perchance the "allotted life" of three score and ten might be doubled.

Mr. Brooks: You have given us a splendid address and I thank you. We will now hear from the Honorable Spessard L. Holland of Bartow. He is well known to all of you, I am sure. Judge Holland:

ADDRESS

HON. SPESSARD L. HOLLAND
Bartow

Mr. President, Ladies and Gentlemen: It is my very good fortune and your misfortune that a member of your program committee heard me make a talk not long ago on Florida's history and, in a day or two, I received a letter through the mail asking me to make a talk somewhat similar at this Horticultural Convention here in Winter Haven. I explained to Pat that probably your Horticultural Society would not be very much interested in history, but he insisted he thought it would be appropriate. I hope you do find the subject interesting before we get through.

One, speaking on history as applied to Florida could, if he chose, speak entirely from the standpoint of horticulture and agriculture. The history of Florida and the development of Florida depended more largely upon the agriculture and horticulture of the state, and upon the activity of the people who came here to develop it than upon any other group. We all have read, of course, with great interest of the Spaniards who came here and fought the Indians. We have read with interest of explorers and botanists and various others, but it remained for American settlers coming here to clear the land, till the soil and actually develop the state. Now other things, transportation, heavy tourist business, manufacturing enterprises, have all followed agriculture and horticulture. It is fair to say from strictly a historical background that agriculture and horticulture have been the most vital factors in the development of the State of Florida.

I think the historical background of Florida is decidedly intriguing and vitally interesting to you, and equally important and interesting to those who come and spend a little while with us once a year. If there is any part of the United States which has a rich historical background, it is Florida. Florida's history is colorful from every standpoint and, much as one would like to dwell on the purely agricultural and horticultural aspect, I am preferring to take a more general view of the subject.

Before I do I want to challenge each of you. I challenge you to examine the history of Florida from the standpoint or origin of the things we consider most valuable for agriculture and horticulture and you will find to your amazement that we have drawn here to this soil the plants and flowers, the trees and fruit and vegetables literally of the entire world. You will find we are vastly more indebted to countries outside the limits of the United States than we are to other portions of the United States when it comes to the furnishing of the things which we consider most valuable, as fruits and vegetables, or most beautiful and most exotic, when we consider gardens. I am not going to develop that point further but if you want to, almost all of the exotic things we like to think of as being peculiarly indigenous to Florida have been brought here by studious people who have looked and sought the whole world over to find things which will make Florida more beautiful. With the Poinsettia, Bougainvillea and the most beautiful palms and almost every plant you find that to be the case. It is interesting to trace the search by people who have come here for things to make our countryside and gardens more and more beautiful, but we have a lot of searching to do and service to render along that line still, to anything like balance the books for the wood burning we have done.

Literally, I may say, we have combed the tropics and the sub-tropics to bring here things beautiful to the eye or valuable for use otherwise and from a historic background to study where things came from and how they came here is a most intriguing subject to go into in this very field of horticulture and agriculture. Do you realize that Florida has had only a few years under American government. About 118 years is what we have had, and prior to that time we

had much more than twice that period under Spanish government, besides years under English government and sporadic experiences under French government, if you can so term that small time occupancy upon the East Coast and that small time in Pensacola and West Florida by the French armed forces. So, from a historic background you would have to search many more generations to discover interesting things, through generations of Frenchmen and Spaniards and Englishmen more than Americans.

In connection with those centuries that came before the Americans there is much of interest, much from the standpoint of agriculture and horticulture. Citrus crops came primarily with the Spaniards—first the sour orange and later the sweet orange—both of them came a long journey from the orient, both of them, as we enjoy them, may be attributed to the old knights of Spain, or to the monks who came on a more holy mission to christianize the natives that were here.

In seeking the origin of other important products you will find interesting stories. I am particularly intrigued with the story of the Turnbull settlement over in New Smyrna. It is a colorful incident in our history, when a young Scotch doctor in London sought to create a Mediterranean Riviera and transplant it to the New World. Old accounts tell a colorful story of this settlement and the bringing in of berries, silk worms and various things from the shores of the Mediterranean, based primarily on the great agricultural and horticultural program he thought he could create. He was defeated, yet it is a colorful history—in 1767 Dr. Andrew Turnbull brought his colony of Greek and Minorcan colonists, many of whom were of gentle birth, to work the huge indigo and sugar plantations he was to develop on the several thousand acres of land granted him by the British crown, and established, in the north section of the "Turnbull Hammock," New Smyrna. The name, given in honor of his wife's former home, Smyrna, in the Mediterranean—and still has its effect on Florida. Many who call St. Augustine their home are proud to claim they are descendants of the Minorcans who settled there.

Then, there is the story of Ponce de Leon, who landed within the limits of the present St. Augustine April 2, 1513, six days after he first sighted the Florida coast, and from that time on the story of Florida is full of romance, tragedy, heroic deeds and high adventure. LaFayette was a youngster only when he came here to serve in the Revolutionary army, the youngest general and practically a son of Washington, so close and intimate was their relationship and contacts. He served without pay and was the only officer in the colonial forces who so served. After the war he returned to France and proved to be not such a good business man as he was a soldier. He lost the fortune he inherited and was thrown into the debtors' prison from which he was rescued by a grant of the United States Congress, to again fall into great difficulties and the Congress of the United States invited him to come back over here as a guest of honor of the American people and he came and was wined and dined and feted and made a hero of as he deserved to be and, further, the American people to show their appreciation gave him a considerable sum of money and a larger sum in United States bonds and then the right to choose out of the public domain of the United States the township of land he might regard as fairest and most promising and that was Township 1, North Range 1, East—the territory in West Florida with a corner on the capital at Tallahassee. Senator Hodges' home stands on a clearing made by a group of Frenchmen who came here seeking to fulfill LaFayette's dream. The deed books and record books in the court house at Tallahassee, Leon County, have the original grant to LaFayette and the will of Lafayette.

The state library in the capitol has other documents giving stories of colorful experiences in the history of Florida. There is the tragic story of the great freeze of '94 and '95, it taking until 1911 to come back to where we were in production. Meanwhile California surged ahead and captured the market. Since 1911 Florida has been endeavoring to win back her rightful place. A tragic story, yes, yet one filled with achievement since we have the fine quality and character of individuals now engaged in what we know as Florida's citrus industry.

It is amusing to see what some of our older folks had to say about the citrus industry. I have a paper carefully prepared by an agriculturist about ten years before this organization was formed and he very definitely decided one thing—that there can be no production of citrus upon anything else except upon stumps of old-time native sour trees. Another item I ran across states with great dignity that after trying out all of the so-called commercial fertilizers offered he wished to tell citrus growers of the state they are all frauds, snares, delusions, and could not take the place of the manure which Mother Nature had provided for that use. (Laughter.) There are funny or sad things you could name without number.

Here, for instance, is a Bureau of Immigration document gotten out by the Department of Agriculture, Mr. Mayo's Department. I don't hold him chargeable for this document, however, since it was put out over the Great Seal of State in the year 1882 it must be authentic. It says, on account of the mildness of our winters in this portion of the state we can raise a great variety of tropical growths; oranges, lemons, limes may be produced with profit in Polk County. The fertility of the soil supersedes that of the other sections and makes unnecessary expensive fertilizers. (Laughter and applause.) You see the oldtimers here realized their opportunity and were doing their level best to take advantage of it and prepare for the greater state they believed was coming not many years hence.

Let me quote from a copy of the Bartow Informant of July 23, 1883, just prior to the establishment of this Horticultural Society, an article regarding the Tampa and Bartow stage line. "Notice to the Public. The Schedule on the Tampa and Bartow Stage Line has been changed and will leave Tampa hereafter at 6 o'clock A. M. on Mondays, Wednesdays and Fridays and Bartow at 6 o'clock A. M. on Tuesdays, Thursdays and Saturdays, arriving at Tampa at 8 o'clock P. M." "This line recommends itself to the traveling public by the first-class accommodations, low rate and for the beauty and health of the country through which it passes." This old writer saw the future of the citrus industry. He was a circuit judge in the territory from Inverness to Key West and he says in an article called "Our Orange Crop"—"We have made diligent inquiry and calculations as to the probable orange crop in Polk County for the year 1883 and we estimate a much larger crop than we had anticipated —nearly or quite 10,000 bearing trees in the county in groves from which fruit is marketed, 500 oranges to the tree to say nothing of many scattering thousands and my many young trees that bear less than 500. From this you see five million marketable oranges will be grown in Polk County this year." They counted oranges one by one on the trees in those days. To go on—"Of interest to our people is the question how to reach the greatest profit from this vast crop." So you see we still have the same question of distribution not solved yet, but we keep trying. Here is something else—"Yet another consideration and that is that all fruit packed and shipped here will be credited to Polk County, which is not the case at present we will then boom sure enough." So much for sidelights.

Then there is the Indian warfare as it affects this particular part of our state. Florida does not sufficiently realize the wealth of its historical background nor capitalize on that wonderful history. People come here to see things traditional and historical and too often we disappoint them, they can't even find out the facts that to them would be interesting. Polk County does not happen to be one of those old counties dating back to the Spanish and British occupancy. It is not along the St. Johns River or the Atlantic or Gulf, however it did have a part in the great Seminole Indian War. First, so many of the characters that loomed to greatness in our national life, soldiers in the Mexican War or the Civil War, were actually here on Polk County soil and had a part in carrying on to a successful conclusion the Indian War here. Let me mention a few. General George Meade, Commander of the Federal force at Gettysburg, was the man who established Fort Meade; Stonewall Jackson spent two years in Fort Meade; Zachary Taylor, later President of the United States, commanded the great expedition against the Seminole Indian forces. Fort Gardner is a post about which one could talk for a longer time than I can talk here. Zachary Taylor, organizing his army on the sea-

coast of Tampa Bay, marched to Fort Gardner as a jumping off place from which to seek to find the Indians, along the west shore of the Kissimmee river, to cross the river and find them at the battleground on the north side of Okeechobee Lake. Regiments of regular United States infantry, one regiment of dismounted dragoons, one battalion of Creek Indians and another of Delaware Indians, brought in from the northwest, a terrible fight ensued, the Indians were largely in the cypress trees, they were excellent marksmen and nearly all of the officers were shot through the head as they charged through the marsh. The battle was a brilliant accomplishment made at terrific cost. There was never any stand made from then on against the armed forces. The Indians, many of whom didn't get there because their legs were so cut by the saw grass and saw palmetto they could not make any headway at all, falling down as they did, the white men did the fighting.

Such people made it possible, by their fortitude and bravery, to carve out of a wilderness which had bafled Spanish and British for over 3,000 years, the state we love so dearly and know so well. Thank you.

Mr. Brooks: Judge Holland, you have given us one of the most interesting addresses we have ever listened to.

I was recently asked to make an address before the Garden Club in Miami on the subject of the Everglades and the history quite surprised me, in like manner to the stories Judge Holland has told you. In 1841 some United States government army engineers made a survey of the Everglades and some of the things they said were, in the light of subsequent events, very amusing. In the first place, they said that there is never any frost in the Everglades; in the second place they said they can be drained, and in the third place, if the Everglades were drained it would make no difference in the climate. (Laughter.)

In closing this meeting, I want to thank you for coming, we have a very splendid attendance tonight at our first session. Now, I want to remind you that the burden of carrying on this work and of getting out a year book each year is handled by memberships, by those who are willing to contribute $2.00 and pin on a badge. You get a fine large year book that gives names and addresses of members and covers the Convention activities. We hope just as many persons as possible will find it convenient to give the Secretary $2.00 for the membership fee and the year book, then put on your badge and wear it so we will know how many have responded to help us out in this way. I thank you all and we will stand adjourned until 9:30 tomorrow morning.

REMINISCENCES OF EARLY PLANT INTRODUCTION WORK IN SOUTH FLORIDA

DR. DAVID FAIRCHILD
Coconut Grove

To look back fifty years and put into words anything but tiny pictures of one's life is almost an impossible undertaking. The difficulty of the task is not, as I once thought it would be, made lighter by accumulations of written notes and photographs. Here in The Kampong the shelves are filled with albums and travel reports dating back to the earliest days of my visits to Florida. Hundreds of tiny red note books record the events of each week. The printed Inventories of Plant Introductions cover an entire shelf and in them I can find the stories of over 100,000 shipments of seeds or plants which since 1898 have come into America to contribute their part towards the making of a different agriculture from that of the Old World which traces its history back to the men and women of the Stone Age.

What he was like we do not exactly know—the man and his wife who came from somewhere across the land bridge which connected Asia and

America, but we do know that he brought with him his dog, for dog skeletons are mingled with his own in the caves and other remains of his early occupancy of this continent. He was a hunter. That he did not bring seeds of any cultivated plants is probable, for when Columbus landed there were nowhere to be found cultivated crops such as had come down through the ages of European history and were the basis of European cultures such as rice, wheat, barley, etc.

In order to give a touch of perspective to this story of a plant introduction garden that was started in a little clearing in "Brickell Hammock" on Biscayne Bay, permit me for a moment to throw on this word screen a few records from the vast literature of agriculture which stretches back to the hieroglyphics of ancient Egypt more than five thousand years ago.

The plants of which we eat the roots or the leaves or the fruit represent objects so old that their beginnings as integral parts of the living bodies of what we call mankind date back beyond the dawn of any written history.

The menu of the average person who sits down today to fill his stomach with those proteins, oils, and carbohydrates out of which his body is formed, is something that has come down in a continuous chain of living history from the days of the men of the Stone Age, and poor indeed is the imagination of anyone who fails to catch the tremendous romance which is in the commonest foods that come upon our tables.

To enjoy an onion soup and not know that the native home of the onion is now unknown; that the Egyptian rulers engraved on the Great Pyramid the sum of money which was expended by them for onions, garlic and radishes to feed the thousands of slaves who built it; that the traditions of the Orient report that onions sprang up from the spot where Satan put his right foot and garlic from where he put his left one when he stepped out of the garden of Eden: is to throw away a bit of romance quite as thrilling as some which the newspapers attempt to charm us with every day.

Spinach, about which there are hundreds of wise cracks in the funnies, seems to have been used by the Chinese in the seventh century; was eaten by the monks of Europe, on fast days only, in the fourteenth century; is mentioned in a cook book compiled for King Richard the Second in 1390; was well known in England by the middle of the sixteenth century; and as early as 1806 was known in America and was represented here by three varieties.

The Celts and early Germans, far back into those days when they wore skins and lived in the forests of Northern Europe, seem to have first learned to grow the turnip, a wild plant in Russia and Siberia. It was known to the Flemish by 1500 but not in England until fifty years later, when King Henry the Eighth served them baked in the ashes or roasted and at the same time used their young shoots as a "salad."

Cabbages grew wild on the chalk cliffs of the seacoast of England, occur wild today on the coasts all the way from Greece to Denmark, and are still eaten in their wild state at Dover on the coast of the English channel. It is today one of the most generally cultivated vegetables of temperate climates, but it was not known to Cato, Theophrastus or Dioscorides, even though the Ancient Greek fables deduce its origin from the Father of the Gods. As late as 1649 it was scarcely known in Scotland and is said to have been carried there by Cromwell's soldiers. Kale, however, was probably the form of cabbage known to the ancients.

The cucumber has doubtless been cultivated in Western Asia for more than 3000 years. It found its way into China at least 140 years before Christ. The ancient Greeks and Romans knew it and Pliny mentions even "forced cucumbers." The Emperor Tiberius, says this same authority, had cucumbers on his table every day in the year. Charlemagne ordered cucumbers planted in his royal estates. It was said to be common in England at the time of Edward the Third, in 1327, but during the wars of the houses of York and Lancaster its cultivation was neglected and it was only after two or more centuries that it was reintroduced. In many countries the cucumber is eaten out of hand as one would eat an apple or pear.

Lettuce appeared on the royal tables of the Persian Kings 550 years before Christ; Aristotle praised it (356 B. C.); Pliny enumerated nine varieties of it in 79 B. C.; the Chinese knew it in

the fifth century of our era; Chaucer, "well loved his garlic, onions and lettuce." It got to Haiti as early as 1565, only 73 years after Columbus' first voyage.

Celery, or "Smallage" as it was called, is a wild plant of the marshes from Sweden to Algeria. It occurs in Egypt, Abyssinia, Baluchistan, the mountains of British India, and also in the islands of Tierra del Fuego and New Zealand. It is the "Selinon" of the Odyssey and was considered by the ancients rather as a "funereal" or ill-omened plant than as an article of food. By the early modern writers it is mentioned only as a medicinal plant. Not until the beginning of the eighteenth century is celery seed mentioned as offered for sale in England.

Most people know that the tomato was extensively cultivated in Peru long before America was discovered, and represents a domestication of perhaps 2000 years. Not until over half a century had passed after Columbus' first voyage, however, does the tomato appear in the literature of Italy. By 1570 it appears to have been known in Europe; by 1596 it seems still to have been grown as a mere curiosity in English gardens; but by another century and a half (1752) it was much used for soups there. It was not until nearly a century later, however, that it was well known to North America. In 1834 it was still almost unknown, the seed firm of Thorburn offering for sale only a single variety. By 1835 someone was growing it in the state of Maine, for the "Maine Farmer" was recommending it "for everyman's table."

The remains of carbonized apples have been found in the ashes of the Lake Dwellers of Switzerland, and these resemble the wild apples still growing in the mountains. They were raised in the gardens of the Phoenicians. Fifty-six sorts were known by Cosmos III, the Grand Duke of Tuscany, as early as 1670. By 1697, 83 varieties were cultivated by the nurseries about London, and according to Hartliff, 200 varieties were known in 1651. Seeds of the apple were included in the famous memorandum of articles to be sent to the Massachusetts Company in 1629, and it is said that Peregrine White, the first European child born in New England, planted apples at Marshfield, near Duxbury, Massachusetts, in 1648. The great horticulturist Downing in 1866 listed 643 varieties of apple in his volume on fruits.

The quince grew wild in the Caucasus and was dedicated to the Goddess of Love by the ancients, having been brought to Italy from Kydon, a city in the island of Crete. Charlemagne enjoined the culture of the quince in France as early as 812, but perhaps the very first quince served at a banquet in England was not until 1446. This fruit reached America in colonial times, since its seeds were mentioned in the memorandum of March 16, 1629, above mentioned.

The pear, a native of Northern Asia, Europe and the Himalayas, has been in cultivation since ancient times. Neolithic man probably ate it, for remains of it have been found in the charred ruins of the Swiss Lake Dwellers. Like the apple it was cultivated by the Phoenicians and the growth of varieties is indicated by the fact that Theophrastus knew only three kinds, Cato knew six sorts, Pliny knew 41, Palladius knew 56, and Targioni-Tozzetti reported the Duke Cosmos III as having 209 sorts in Tuscany. Whereas in Great Britain only 64 kinds were known in 1640, by 1842, 700 varieties were recorded as distinct by the Horticultural Society Garden tests of that period. In America, pears were planted as early as 1647, one being planted by Gov. Prince at Eastman, Massachusetts, in 1640, and the "Stuyvesant" pear planted in New Amsterdam, was said to have been imported from Holland in 1647. The American Pomological Society recommended 115 varieties as worthy of cultivation as early as 1879.

Even such a sour fruit as the currant has a rather long history, for in 1597 it appeared on the London Market, according to Gerarde, and Camerarius gave directions for sowing the seeds of the wild currants in gardens which procedure may have led to the origin of cultivated sorts. This was in 1586. In 1601, Clusius speaks of a very sweet variety which he saw growing wild in the Alps. When it came to America I do not know, but Downing lists 25 varieties as early as 1866, all but 12 of which seem to have been discarded by 1885.

When we come to mention the Cereals, those grain crops upon which man seems to have leaned

heavily for his food support in the early years of his emergence from the Late Stone Age, we are confronted on every side by vistas of many thousands of years. Barley was a grain crop in Egypt in the Fifth Dynasty, over 2440 years before Christ, and together with hops was made into beer from the remotest times. Wheat kernels have been found in the debris left by the Lake Dwellers, and stands of it were figured as a cultivated crop by the Egyptian artists of the Fifth Dynasty.

The origin of maize, a South American plant, is still a puzzling question, for there appears to be no wild plant like it in existence today. This leads to the suspicion that it originated as a hybrid of certain grasses and even one of these seems to have become extinct. Maize is a very old cultivated plant. I have read that the great Humboldt records that a Toltec leader named Xinhtlato is given the honor of reviving the culture of this marvelous food plant sometime about 1250 A. D., when its culture and the practice of making corn bread were in danger of being lost. Is it imaginable that the corn plant might have become extinct?

But I will not tire you with a recital of the origin and histories of these cultivated plants, fascinating as they are to me because of their bearing upon the general question of Plant Introduction. I have told them with the object of emphasizing two points, viz.: the curious permanence of this stream of living substance, these edible plants upon which we humans subsist; and the slowness with which any new plant species comes to be incorporated in the select crowd called the "cultivated plants of mankind."

It is evident that whereas centuries have passed before a new application for admission to the circle of the elect can be said to have become established, once in that circle, centuries may come and go before it in its turn is left behind and others take its place in the slow progress of mankind toward a new setup of cultivated food plants.

As I review, therefore, the results which are apparent after forty years have gone by, of the attempts which my associates and I have made to induct into the sacred circle of acceptable food and otherwise useful plants, species that were strange to the American public, I get comfort from the thought that the process seems always to have been an extremely slow one, involving not decades but often centuries for its accomplishment. There was no particular reason, for example, why the potato which is now acknowledged to be a very superior vegetable should have been characterized by Mortimer in his Gardeners Kalander, a century after Raleigh grew it in 1585 on his estates in England, as "near the nature of the Jerusalem artichoke although not so good or wholesome, but it may prove good for swine," and by Miller in 1754 as "despized by rich and deemed only proper food for the meaner sorts of persons." I say, no reason. I mean no reason other than the "unreasoning prejudice of taste." Nearly a century and a half elapsed between the time of the potato's introduction and cuture in Italy in 1596 and the time of its cultivation in the Highlands of Scotland, for example—a time period almost as great as that stretching back from this present moment to that of the signing of the Declaration of Independence. I realize that someone will say that the slowness of transportation in those days will explain this. If this were true, then the introduction of a new and excellent fruit or vegetable should be, let us say, twenty times as fast now as it was then, in making its way with the public. I think this is much too simple an explanation, for it does not take into account the resistance to the introduction of any new food which seems to be an instinctive part of the behaviour of the human animal. This resistance to change is, I imagine, about as strong now as it was in the sixteenth century, at least when it comes to such things as food. So I find at the close of this nearly half a century of effort to get new vegetables and fruits eaten by the Americans of my acquaintance, that many have not yet learned to like the superb Mango, and about as many have still to acquire a taste for the delicious Avocado, while the Dasheen and Yautia and the Canistel and the Guanabana, not to mention the sprightly flavored Tangelos of Swingle, are lagging behind in a way that would appear to be quite characteristic of fruits and vegetables that are trying to climb up into the ranks of the elite.

I never saw Florida until I had visited the

tropics of the Old World and, strange as it may seem, I saw my first orange on the shore of the Bay of Naples. It was while there that I got those stirring letters from my old friend, Walter T. Swingle, all of which I still have. Let me read from one written from Eustis on December 22, 1893:

"My dear Friend Fairchild:

"I was overjoyed to have such a full letter from you as your last. I received it the very day I arrived in Eustis after a 29-hour ride from Washington. I was beside myself with joy to reach this delightful climate again. Before I had left Washington, snow had laid a week without melting and I had found Waite's little overcoat rather too thin. Here mocking birds were singing—I had never known before what a cheer they give—and there was light enough in one day to last Washington a week.

"The blue lakes and sky, the lovely orange trees laden with ripe fruit, the mild weather, all seemed too good to be true. I had never before left the North in winter for the South and did not therefore fully realize what a difference there was.

"I have found Webber hard at work actually growing fat under the exhausting heat of summer! The laboratory with its well laden periodical table and clean work tables seems too good after having worked at the Division.

"We have been very busy writing our part of the annual report and I have not been able from this cause to answer your letter sooner. We have made practically three reports this year, one to the State Horticultural Society in April, one when Galloway thought the Division was going in July, and one now. I am heartily tired of such work.

"We are having splendid success in getting cooperation of growers—we now have experiments going in eight groves, and in many cases the owners furnish the labor necessary.

"I am now working to have a permanent endowment fund for the laboratory. I shall get small groves donated free in perpetuity to a board of trustees—the money to be used in studying oranges. Probably the first garden of this character will be at Altoona where Mr. Cunningham thinks he can secure a good four-acre piece, fenced, cleared and planted to old stocks. In a few years the income would render the laboratory independent of any government or state aid and in any event furnish a fund of pocket money easily accessible."

Then followed an account of plans for the acquisition of an orchard and the experiences of his friend Ceunningham, who had made a good thing in oranges and was selling his crop to commission men on the open market at a good profit even though it was a time of serious depression. He was then artificially sweetening his oranges on the trees by means of a special spray.

The report which Swingle referred to as having been made to the Florida Horticultural Society will be found in the Proceedings of that year's meeting, held at Pensacola on April 11, 12, 13, and 14, 1893—forty-five years ago.

This report by a young man then 22 years of age was a remarkable one and deserves to be especially mentioned here, as it had a direct bearing upon the later course of plant introduction in America.

The published record reports that: "Prof. W. T. Swingle read the following paper on, "Some Citrus Fruits that Should be Introduced into Florida." His leading paragraph outlines the situation as it appeared 45 years ago to the mind of a mere youth from the plains of Kansas—for Swingle was a classmate of mine in the Kansas State Agricultural College in Manhattan. It begins:

"The advances made during recent years in horticulture are largely due to the introduction of new varieties of cultivated plants or to the improvement of old ones by careful selection and hybridization. When we consider the great changes the introduction of a single good variety may work in the horticulture of a whole district or even whole states, it seems curious, to say the least, why more effort has not been made to procure all known varieties and test them thoroughly in each region.

"A brief sketch of the introduction of citrus fruits in Florida may not be amiss as an example. The sour orange (*Citrus bigaradia*) was probably introduced by Spaniards at about the time of the discovery of America. Afterwards sweet oranges,

limes and shaddocks were carried to the West Indies, and from there the sweet orange probably came to Florida. For the first forty years of modern citriculture in this State, practically only a single variety of sweet orange was grown.

"The only lemons known for years were the 'Florida rough' and the Sicily.

"Probably today we would have a scant dozen good varieties of citrus fruits in America, if General Sanford had not by his liberality inaugurated a most extensive introduction of citrus fruits from all parts of the world, but particularly from Italy.

"Rev. Lyman Phelps, one of our members, assisted and advised Gen. Sanford in these importations. Hundreds of varieties and strains were introduced, and it is probably no exaggeration to state that two-thirds of our desirable varieties and a goodly share of those grown in California were brought here and first tested by Gen. Sanford."

There followed a fascinating account of certain citrus fruits and their relatives which Swingle had discovered in the literature and which he thought worthy of introduction, such as *Murraya exotica, Clausena wampi, Clausena wildenovii, Feronia elephantum* and *Aegle marmelos,* some of which have found a congenial home in South Florida since that time.

It was his experience in the little laboratory at Eustis, which he shared with his friend, H. J. Webber, which made him interested in South Florida and led him in 1897 to take the first steps in the establishment of a Sub-Tropical Laboratory and Garden on Biscayne Bay. As mentioned in my paper read last year at the Ocala meeting of this Institute, Swingle surveyed the land and took title to it in the name of the Government but to our bitter disappointment the legal experts of the Department refused to accept the title, preferring to take a ten-year lease on it. This error on the part of the experts led to no end of difficulties. This was the first field laboratory of any kind that the Federal Department of Agriculture had established anywhere in the United States outside of Washington. Furthermore, these experiences at Eustis made Swingle enthusiastic in his support of the general project of Plant Introduction, and it was as much his conviction of their possibilities as it was my friend Mr. Lathrop's belief in them and Secretary James Wilson's interest which led to the initial step being made which originated the Section of Foreign Seed and Plant Introduction — the "S. P. I.," as it came to be called later on.

I have in my collection of letters of that time one from Webber to Henry M. Flagler and in it he outlines the separate activities of his two friends, Swingle and Fairchild, who he expected would work together with him in the introduction of suitable plants from all over the world. It was written in 1897 when I was in the tropics of the Orient and I never saw it until long after the starting of the little Section of Foreign Seed and Plant Introduction.

My own first visit to Florida was in 1898, when I went to Miami to see Webber who was then in charge of the garden of six acres, which Mrs. Mary Brickell had offered to the Government, and of the frame laboratory, which he was erecting on an acre of land that was washed by the waters of Bay Biscayne, and for which the funds had been given by Flagler.

When I arrived at the tiny railroad station which then was near the new Royal Palm Hotel, now long since a thing of the past, I saw around me little but pines, with here and there a few wooden houses scattered about, for the population then was about 4000 for all of Dade County. I was with James Ingraham, the Vice-President of the Florida East Coast Railroad, and after lunch he took me to call on Mrs. Julia D. Tuttle, who lived in a little house near the North Bank of the Miami River, just across from Brickell Point where Mrs. Mary Brickell had her home and where earlier the old store stood from which Mr. Brickell sold groceries to the Indians.

There were few other houses about. Mrs. Tuttle had some red hibiscus bushes around her house and some sisal plants and a few other shrubs, as I recollect. She served tea and talked with Ingraham about the railroad. In those days the coming of the railroad was the great event, for it was supposed to bring with it everything in the way of comfort and civilization that the country could provide.

The following morning I hired a colored man to drive me far out along what was then little

more than a trail through the hammock that stretched in one unbroken mass for a mile or more south of a new bridge across the Miami river. I had heard about this "tropical jungle" from my friend, Mrs. Bryan Lathrop, two years before as we sat on a hotel porch overlooking the volcano Gedeh in West Java. She asked me if I had seen the marvelous jungles of South Florida and named in particular this hammock which she had driven through going to Coconut Grove.

It struck me as a piece of splendid tropical forest but without the tall trees and immense climbers of Java. I drove on in the morning sunlight, becoming more charmed by the wildness of the scene as I drove, and soon came to a tiny clearing on the Bay side of the road where a frame building was being erected. Beyond the framework of the building I could see the waters of Biscayne Bay, for the acre of land that Henry Flagler had given to the Government ran from the road down to the shore. A pier of rock was built from which it was expected that the botanists who were to work in the laboratory would have access to the water, and perhaps some day there would come a "Biological Station" such as had been built on the Bay of Naples and in which I had spent several months in 1894-95.

It was with an enthusiasm of which, alas! I am no longer capable that I brought my kodak to bear on that little laboratory. I seemed to see a great center of biological research growing up there, and felt that I was making a historical photograph which years later, on some such occasion as this perhaps, I would show with pride and have for comparison with it one of a marble palace of research. Alas! how little I knew about the drift of things in the then wilderness of South Florida.

I went across the road and found Webber there among some scattered leggy trees and shrubs that had just been planted out in the chalk-white rocky soil that had been laid bare by the cutting off of the Gumbo Limbo and other hammock trees. A small wooden dwelling house had been erected in one corner of the six-acre tract which Mary Brickell had offered to the Government but which, as I have said, had been refused by Uncle Sam, who at that time was opposed to the accepting of any land from anybody. Those were non-paternalistic days in Washington.

The prospect was anything but promising. The soil seemed to be "all rock." There was a feeling of aridity about the situation. I didn't like the glare of the white sand and rock nor the looks of the starved little plants. But there was Webber full of the optimism of one who had a better knowledge of what could be done with the land than I had, and bursting with plans for the development of the laboratory across the road for which Flagler had given him a thousand dollars.

He had begun to breed and select guavas and had some promising new varieties already coming on of which he was proud. Pineapples were on the program too, and I was to see later thousands of little pineapple seedlings filling the propagating houses in Washington and subsequently to taste the largest and most delicious pines I have ever tasted that came from the pineapple patches in Florida where Swingle and he tested out these thousands of seedlings. Alas! Where are those pineapple sorts now? Gone with the winds of time and change.

Webber wanted me to see the possibilities of South Florida, for he imagined I was to "scour the world" for plants for this little garden. We all had large plans in those days and a free hand.

I drove to Cutler to see a Mr. Boggs and Dr. Richmond, both with a love of plants in their make-up. The former came out of the woods in his work clothes and so impressed me that I have never forgotten his image as he stood there in the sunlight and talked of mangos and avocados and asked me a lot of searching questions about the tropical plants I had seen in my travels in Java. There was in a clearing near Cutler a small tree of the Canistel (*Lucuma nervosa*), and since I had never seen the species I was interested to taste it, and found it, as most people do at the start, a curious but not unpleasant fruit. I have since become very fond of this fruit and have trees of it all over The Kampong now. My best seedling bears fruits that are keenly appreciated by my northern visitors during December and January, and I have another seedling which holds its fruit into March, but there are still others with fruits that actually stink and are offensive.

Dr. N. S. Richmond had some papayas, little starved things each with a single large fruit on it, and I recall especially a single seedling alligator pear. There were no budded trees of this fruit in existence then and I had previously seen the fruit of the alligator pear only in Hawaii in 1897, where Gerrit P. Wilder was experimenting with some seedlings on his place in Honolulu. Dr. Richmond seemed a good plant experimenter and I made friends with him at once, and when I got back to Washington I began sending him all sorts of plants. How little I dreamed then, however, that he would show me later the Jumbie bean (*Leucaena glauca*) in his yard and call my attention to its possibilities as a weed. Still less did I imagine that the Sausage Tree I sent him, and which he gave away to a lady friend, would be today the center of a mob of tourists in automobiles, and that its present owner, Mr. Black, would have exploited it and made it one of the most famous trees in the world from the point of numbers of its admiring visitors. But I think I did believe that from the papaya something of great value would emerge, for I started at once a campaign of introduction, getting seeds from every corner of the tropical world, until we had in the little garden some eighty kinds or strains or seedlings of different character. I will not enter here into the complexities of this amazing species—it is the fastest growing tree I know of in the world, and one which produces an amazing proteolytic enzyme in its latex, which, according to Dr. Bergmann of the Rockefeller Institute, seems destined to play a great role in the modern studies which are going on in the biochemical laboratories of this country to determine the structure of the protein molecule. These researches are destined, it would seem, to open the door into a whole new world of possibilities, the extent of whose application still lies beyond our imagination even. The first step into this field lay in the clarifying of beer by means of the papain in its dried form, and Dr. Max Wallerstein, the discoverer of this action of the juice of the papaya, came at my suggestion to Miami in 1914 and we planted for him the first orchard of papaya plants ever set out here. When it transpired that the labor required would make the venture unprofitable, his friend Hagemann, a graduate of Princeton, went in to the growing of these fruits for the table, picking out one of the loveliest hammocks in South Florida for the purpose. What a scolding I got from my old friend, Mr. Lathrop, for aiding and abetting Hagemann to destroy the great oak trees in that hammock. The site of that lovely spot under the branches of whose oaks Hagemann grew his delicious papayas has been swept by storms and bears little resemblance to what it was then.

My first stay in the Biscayne region was short, but it was long enough to convince me that there was, down here on the shores of this Bay, a zone in which some of the gorgeous tropical fruits and flowering trees I had seen in Java and elsewhere could actually be grown. I never stopped to consider that this area was small, and did not apparently dream of the resistance I would encounter on the part of the various Secretaries of Agriculture who would have control of the funds of the little Section and who, strangely enough, were almost without exception to come from the "Corn and Hog Country" of the Great Plains states where I had spent my own boyhood. Thanks to the fact that no secretary can watch very closely what goes on under his very nose, my associates and I slipped in all sorts of tropical seeds and plants from all over the world and sent them to Miami and recorded them, along with the hardy grains and alfalfas and Brome grasses and hardy elms which we brought in from the wilds of China and Siberia. Hardier varieties of plants which would grow in what has become the "Dust Bowl" of today were considered one of the chief objects of plant introduction in those days. I sometimes wonder now, perhaps idly, whether the encouragement which the introduction of those so-called hardy varieties gave to the early settlers of the Dakotas was entirely justified in the light of subsequent developments. With the melting of the gigantic ice caps that cover the poles, the highly speculative question has been raised by Humphreys, I believe, as to whether the Great Plains are not in for a very slow but steady decline in their average rainfall as the centuries pass.

Soon after this visit to Biscayne Bay in 1898 I went on my first expedition after plants with Mr. Barbour Lathrop of Chicago, who, coming

to Washington a year after the little Section was started, convinced me that I knew nothing about the world which I had set out to "comb for plants," as the newspaper men were wont to say.

Since the tropics were fuller of plants than the arctic countries and since the arctic could not be explored except during a few months in high summer, most of our travels were in the warmer parts of the globe and I got interested in those plants which I saw were being used by the peoples of the tropics. The result was that a stream of tropical plants began pouring into the little garden on Brickell Avenue. Naturally enough the majority of these perished, for in those pioneer days the technique of planting out little seedlings in the rocks of the Miami region had not been worked out. It took years to prove that plants should first be grown in good sized boxes. The death roll became something quite appalling. I recall asking for a "show-down" from P. H. Rolfs, who was then in charge of the laboratory of plant pathology and the little garden as well. It was very discouraging. My superior, Dr. Galloway, was even more discouraged than I, for he had never seen South Florida. The gardeners in Washington who propagated in the greenhouses many of the newly introduced species began to knock it as a place of rattlesnakes and rocks—nothing more, and even told the little Englishman, "Ed" Simmonds, then one of their number, who was considering throwing in his lot with the Brickell Avenue Garden, that he would be wasting his life down there in the wilderness and that he would get bitten by a rattler or be eaten up by mosquitoes. Finally, Dr. Galloway decided for purposes of economy to close the garden and save the money—some $3000 a year, I think it was—and sent his assistant, P. H. Dorsett, with hammer and saw to Miami to box up the books and get rid of the plants and close the whole thing up forever.

Dorsett found conditions not at all as he had been led to believe they were and wired back his opinion that it would be a mistake to abandon the garden. Men like Dr. John Gifford and others then took a hand against the closing of the little garden in which they visioned possibilities for the growing community of Miami, where there were 10,000 inhabitants by that time. They fired telegrams into the Congressmen's mail baskets and organized a committee of citizens to take over the garden in case the Government abandoned it. The result was, as of course it should have been, a capitulation on the part of the "authorities in Washington." I have among my letters a prized one, written years later, in which Dr. Galloway admitted that he had been mistaken and that the Plant Introduction Garden in Miami was, he thought, destined to play a very important role in the development of the State and was an activity of the Federal Government which could be logically defended and which should not interfere with any of the State activities in the field of agriculture.

This crisis passed, things went on more swiftly, and besides, the Spanish-American War had made the American public more conscious of tropical things. Then, too, the coming need for rubber had made the Secretary aware that one of the most important products of American commerce was tropical in character. I have in my file letters written in 1900 at Secretary Wilson's instigation, asking me while I was out in the Oriental tropics to look into the rubber situation there—even to secure thousands of seeds for planting out somewhere in the United States. I had to write back a discouraging report, for even as late as 1900 the belief among the best experts in Java and Ceylon was that rubber growing would never pay as a business and must be carried on as forestry is, by the State.

Travel after plants, and the work of organizing the Section, and my marriage kept me from Florida until the winter of 1912, when I came down with Mrs. Fairchild and spent a month, February 17 to March 13. As I write these lines I have before me the rather complete journal of that trip, and since it gives a picture of the conditions of the little garden on Brickell Avenue, I propose to use it in the making of my "thumb nail sketches" of the plants in it.

Many of my generalizations in that journal were rather wide of the mark but some of them were not. For example, I wrote:

"I would not be surprised to see the day when 100,000 people are living along the coast between Palm Beach and Homestead. In 1898 when people talked of East Florida as the Riviera of

America, I thought they were dreaming. Now I believe this is likely to come about. The drift of all classes of people from the cold North southward is one of the most interesting spectacles in American life. I believe it is a psychological phenomenon which will grow immensely during the next few years and affect the development of subtropical agriculture more radically than any other existing factor.

"Agriculture in a region where the individual plant must be cared for almost as carefully as though it were a potted plant—fertilized, pruned, sprayed, pollinated and protected from cold, cannot fail to develop an intelligent knowledge of plant physiology and pathology quicker than the agriculture of a well-watered, extremely fertile region where trees and shrubs grow if left alone. Where plants die quickly if not properly cared for, people are going to learn to care for them. Miami is like one big botanic garden and we had the remarkable experience of chasing in automobile from one private garden to another six or eight miles away to see a rare tree or shrub. Under these conditions plant amateurs are sure to develop."

We spent a day with Mr. Ingraham at St. Augustine and he told us of the great profits of grapefruit growing at Kendall, where 2000 grapefruit trees netted the East Coast Railway $567 per acre. Pineapples brought $125 per acre, he said, and vegetables $200 per acre, and potatoes $120 per acre at Hastings, and he thought Miami was doing then a $2,000,000 business in vegetables.

I was at this time hunting for suitable places where we might plant out the Chinese Tung tree ("Wood-Oil Tree" we called it at that time), and Mr. Ingraham told me that his company was going to open up a road from Titusville to Lake Okeechobee and that if we wanted him to, he would find a man and five acres of land on which to plant a grove of wood-oil trees. He understood that we proposed to furnish only the trees and had no funds with which to pay any expenses of maintenance. For some reason nothing came of this offer. We had sent two trees to the Tallahassee cemetery, and one of these, which had been saved by Wm. H. Raynes, once a ship's carpenter, had begun to attract our attention to that locality. Later Tennent Ronalds, a Scotch gentleman farmer, had set out the first orchard of this tree on his Live Oak plantation there. I see, however, that I advised that some plants be sent to Gainesville in 1912, fearing that Tallahassee might prove too cold. Even as early as this year we had begun to feel that the wood-oil tree would not thrive in the Brickell Avenue Garden, and had made a large nursery planting of imported seeds in a clearing in a hammock in Brooksville.

I note in this journal of 1912 that Fred S. Morse, whom I had met in 1898 and who was then the only real estate man in the Miami region, had told me that he believed Mr. Ingraham would get for us, should we wish to enlarge our plantings in South Florida, 60 acres of land at Perrine. I noted in my journal:

"Land is now selling for $60 an acre there and Mr. W. J. Krome is going to settle down there and be a power in horticulture, I believe. I would favor Homestead if land can be found there. I think the matter ought to be given serious attention before the land becomes too valuable."

How Miami had grown! I see my journal remarks:

"Aladdin's lamp could not have transformed a town as Miami has been transformed since I last saw it in 1898. Imagine traffic so heavy that carriage drivers can only cross streets at regular crossings."

We drove in a two-seated, one-horse carriage to the little garden about 6:30 A. M. and in my imagination I can see now that dear old plantsman, Edward Simmonds, as he stooped and peered at us through a jungle of Swingle's citrus hybrids that filled a good part of the garden. The entry in my journal continues:

"Mrs. Simmonds insisted that we stop with them at the tiny cottage in the garden and the stop was altogether a memorable one. Seldom have I enjoyed so close an acquaintance with plants as I did during our week's stay there. I am convinced of the fallacy of large laboratory buildings. A shanty in the midst of plants for me! I believe the Bureau is wasting many thousands of dollars, and more than this—*inspiration*, by not housing its men in the midst of the plants."

I am still of this opinion after 25 years have gone. Buildings do not make a garden; they often only serve to keep one farther away from the plants.

Let me take you through the garden as it was that day in 1912. An avenue of Canary Island palms led from the street to the cottage and I did not like it very much, for I had seen the palm everywhere in the Mediterranean region and it was common in Florida. I recommended in its stead a row of Akee trees (*Blighia sapida*), as the species seemed to be doing well in the garden and I loved its brilliant red fruits. This was not done and after 25 years there are only a few scattered trees to be found in the Miami area. Yesterday I set out some which Dr. L. H. Baekeland, who has made a close study of the Akee, gave to my brother-in-law, Dr. Grosvenor, President of the National Geographic Society, who has bought a place next The Kampong.

The laboratory across the road had become by this time a historic one because of various investigations carried on there. Crotons galore filled its front yard and I asked Simmonds to take them away and plant the Carissa in their stead, for from the quantities of carissa seeds which I had sent in from Natal a host of seedlings had grown. A carissa hedge stood for twenty-odd years along the entrance to the potting shed and parts of it are still standing there. Today there are many thousands of beautiful carissa hedges and individual plantings in South Florida, and who is there who has not tasted carissa jelly? My old friend, the late J. L. Meade of Oviedo, brought the Carissa into North Florida from Australia sometime in the eighties, so Reasoner reported, but I think that most of the plants around Miami came from the Natal seeds.

The sausage tree (*Kigelia pinnata*) was doing well in the garden then, and also the Cajeput tree—the latter coming from some seeds which Dr. Gifford imported direct from Australia and turned over to Ed Simmonds to grow because they were so tiny. Ed sent them up to Washington to be grown in the greenhouses there, as he had no greenhouse facilities at the garden, and later the plants were returned to him and distributed. Who could have imagined that from a row of them planted by Robert Werner in 1914 at an ephemeral experimental farm which was started near the settlement of Davie by some real estate men, Vance Helm among them, there should grow an actual forest of cajeput trees which would destroy even the citrus grove that had been planted close to them? Is someone to see the cajeput become one of the character trees of the Everglades, I wonder. Other trees from other seeds imported a little later by Mr. A. H. Andrews of the American Eagle at Estero have invaded the swamps of that region as well.

Ed Simmonds was hand pollinating the flowers of the Cherimoya (*Annona cherimola*) and had already budded the Sugar-apple on the native Pond-apple (*A. glabra*), and the start had been made towards the origination of the cross between the Cherimoya and the Sugar apple which is today the most fruitful variety of this delicious fruit we have in South Florida.

From some seeds of a curious fruit called the Kaffir-orange (*Strychnos spinosa*) that I had picked up at Mozambique had grown several low, spiny, bushlike trees and these were laden with their perfectly round, hard-shelled fruits. These fruits were so round and hard that to amuse friends in Washington, I took some to a meeting of the Botanical Society in the Cosmos Club there and rolled them down the aisle as if they were made of lignum vitae and the aisle were a bowling alley. How little I dreamed that the President of the Macmillan Publishing Company, Mr. George P. Brett, would one day serve me a "Strychnos Cocktail" made from the pulp of the Kaffir-orange grown on his place south of Coconut Grove, or that it would charm by its fragrance one of my nieces, confined to her bed for weeks. Much less, that Ed Simmonds would one day come with a Kaffir-orange tree in a box and with much ceremony plant it near a little house on the bayfront that we had bought and that it would be the very first tree planted on what has become The Kampong.

Thirty different varieties of avocado in boxes—all budded sorts—filled the slathouse in 1912. This was 11 years after Geo. B. Cellon first budded the Trapp avocado and put it, the very first budded variety of avocado, on the market, and the first boom of this new fruit crop was on in Florida, where it started some years earlier than

in California. The 70-year old pioneer of Miami Beach, Mr. Collins of New Jersey, had set out over 100 acres of avocados, mostly budded Trapps, and this was then one of the largest plantings of budded avocado trees in the world. Owing to the uncongenial character of the shell-soils of the beach and the salt breezes that constantly blew across that area, the trees failed to fruit and the venture was a complete failure. In the garden on Brickell Avenue three avocado trees from Guatemala were standing: the Colla and Collins, sent by G. N. Collins from Guatemala in 1906, and the Winslow, presented by Consul General Winslow of Guatemala City. These were six years old from seed but I see no mention in my 1912 report of their having yet fruited. I recall being much disappointed not to see in the collection the hardy Chilean avocado of which I had sent a large box of seeds from Santiago in 1899. It was not until 1919 that I found this variety growing on the place of C. P. Taft in Orange, California, and he told me it was the first avocado seed he had ever planted. Later I had the pleasure of presenting Taft with the Meyer Medal for his distinguished work on the pioneering of the avocado in California, in which the seed of a fruit he bought in the market played the chief part.

The Colla, Collins and Winslow trees in the little garden began to attract attention soon after my visit in 1912 because of their seedlings. These turned out to be hybrids with the West Indian race, and we were obliged to hunt names for them that would show their parentage. The Collason, Collinson and Winslowson were the first seedlings to come from these trees, and who would say that these have not played something of a role in the avocado business of South Florida. The freezes and hurricanes and factors of the commercial market demand have eliminated them from many orchards, but nevertheless they were eye openers because of their hybrid character and the fact that they were superb tasting varieties and matured in the fall or winter.

I look back to those early days of the great avocado industry with pleasure for they were days of excitement and surprise, and while we may not have appreciated quite fully the importance of the events taking place around us, for no young people do, we certainly were active in our search for avocados that would do well here.

Two years after this visit Wilson Popenoe, who had joined our research staff, came on the scene in Florida and introduced a collection of the varieties which by this time had come into prominence in California, such as the Taft, Dickinson, Meserve, Solano, Blakeman, Ganter, and Harman and the now famous Fuerte which his father's West India Gardens at Altadena, California, had introduced in 1911 from Atlixco, Mexico. Great were our expectations for there had been some unparalled publicity connected with the furore over such varieties as the Harman and the Taft, etc. But, alas, it soon was evident that not one of the varieties which had done so well in California was happy in South Florida, where the summers are rainy and the soil is surcharged with lime.

Popenoe was sent to Cuba for the best Cuban sorts but these seem all to have faded from our collections. Then, in the fall of 1915, at the meeting of the California Avocado Association, Dr. H. J. Webber introduced a motion to the effect that the Association should petition the Secretary of Agriculture to send an explorer to Guatemala to search for the best varieties of avocado to be found there. We chose Wilson Popenoe for this work and from September, 1916, until mid-December, 1917, he was actively searching for promising seedlings through the lowlands and highlands of Guatemala.

In preparation for the receipt of the budwood which it was expected he would send in, Edward Simmonds planted seedlings of the Collins tree in the garden at Buena Vista which I shall refer to later. He did this because they showed unusual vigor of growth and he thought they would prove a suitable and uniform stock into which to bud. In October the budsticks began to arrive and one after another he saved them; to insure the getting of the budwood from the same trees again, should he fail, Popenoe cut his field serial numbers into the bark of the trees so that there could be no mistake in identification. Thanks to the skill shown by Ed Simmonds and by Ed. Goucher, who also budded many of the same varieties in the greenhouse in Washington, nearly

every one of Popenoe's thirty Guatemalan sorts was saved and at least a preliminary test of each was made. Unfortunately, the stock chosen did not prove congenial at all to some of the sorts, although it did to others. I have a set of photographs of the unions made by these imported buds on the Collins seedling stock. It was apparent from the very start that certain ones, for some reason unknown to us, were not adapted to Florida conditions. While this series was being tried here, a similar series was made in California.

Wilson Popenoe's explorations of Central America after avocados deserve to go down into history as one of the most thorough pieces of horticultural plant hunting work ever carried out, for he not merely secured seeds, which is a comparatively easy thing to do, but successfully landed here thousands of scions in such a condition that their buds could be budded into stocks waiting for them in Florida and California. This was long before the days of air mail.

So much interest was aroused by his work and the new avocado industry came on so fast in Florida and California that in 1920 he was sent to Costa Rica to explore that country for superior avocado seedlings. From there he went down into Ecuador, to the noted Chota Valley, and as a result we had for trial varieties from both those countries. The Ecuadoreans disappointed us, as did also most of the Costa Ricans, but one of these which Popenoe called the Alfaro, S. P. I. 50680, has on The Kampong at least turned out to be a promising dwarf sort which may later be heard from, I think.

He had given serial numbers to his collections but as I had been dealing with S. P. I. numbers until I was tired of them, I asked him when he got back why he could not give the various sorts Mayan names which we could publish in the Inventories which were then going through the press. He returned in a few hours with the most amazing lot of easily pronouncable Mayan names imaginable and these names the varieties bear today. This procedure was in strong contrast with the methods of some of those unimaginative persons who would discard the charming Arabic names of the date varieties which we sent in from Algeria, Egypt, and Arabia, attached to our collections of offshoots, and substitute high-sounding English names.

Today it is perhaps the Itzamna variety of Popenoe which has proven the best of the lot in Florida because of its unusual hardiness and lateness. (This is 55736 of the printed inventories and not 43486, which failed to live and is now only one of the many dead numbers which are to be found in the Inventories.)

Whether "ultimately," as we so foolishly are inclined to say, one of the direct introductions of avocados from Central America or Mexico will prove to be the great commercial variety here, who is wise enough to say? More probably it may be from the hybrids of some of them that the local sorts will come on which the grove owners will depend. Curiously enough, the Collinson, that still holds its own in some quarters, originated as one of the stock seedlings upon which Ed Simmonds budded one of the Popenoe importations at Buena Vista Garden in 1916. Mr. Simmonds used to relate how it was blown over by a wind storm and how he asked the old colored man, Stafford, why he hadn't staked it up properly. In a slovenly way he had put up against it a board with a knot hole at the end and the sharp edge of the board had torn the bark off. Simmonds scolded him for such carelessness. To this he replied, "I was going to dig it up and throw it away. Any tree that blows over is no good anyhow." Shortly after this Stafford had a dream in which Simmonds appeared and it so frightened him that he quit his job and never returned.

But I must get back to the little garden on Brickell Avenue as it was in 1912. Turning over a single page in my Journal I find a photograph of Simmonds holding up a Sufaida budded mango plant in a box showing its splendid root system. In those days budding the mango was not understood as it is today and most of the nurserymen preferred to inarch them in the old-fashioned way of the native Indian horticulturists. I saw yesterday a field of several acres at the Coral Reef Nurseries where Ross and his men were budding mangos apparently as easily as peaches are budded in Maryland. It has taken years of study, though, to bring this about, and in 1912 Mr. Cecil Hickson had a scaffold around his Cecil

mango tree that was ten feet high. I recall that in 1913 Simmonds had rows of introduced mango varieties that he had budded on seedlings set under an extensive slat shed out of doors—one of the first successful field buddings of the mango, and George B. Cellon, who was the pioneer in mango budding, as he was of the avocado, had praised him, saying they had made the best growth of any young mangos in Dade County. In those days we were afraid to plant imported mango trees outside for fear of losing them in a freeze, and the trees planted under slat protection were allowed to grow through the slats before these were taken away.

Five potted plants of the Gordon, the Peters No. 1, and the Pere Louis, which Mr. Lathrop and I arranged for in Trinidad in 1898, arrived in July, 1899, at the garden. These were the first mangos introduced by the Section of Foreign Plant Introduction, but the "Number 11" was already established here, according to P. J. Wester. He relates that when he had charge of the garden, in 1908, there was still standing on what was known as the "Gilbert Place" on the south side of the Miami River a large tree that a Dr. Fletcher had planted as far back as 1862. There is no evidence that the mangos brought in by Henry Perrine lived after the massacre, although he mentioned the mango as one of the fruits he proposed to introduce, in his famous letter to the Secretary in 1833, and doubtless brought seeds of it in. Since the No. 11 was the mango that Captain Marshall of "Flora," frigate of Lord Rodney's fleet, took away from the Frenchman who was bringing it from the Isle of Bourbon to Hispaniola in 1782, and since the No. 11 was known to come true to seed, it is quite possible that the Fletcher tree came from a seed of this famous No. 11 tree, which Captain Marshall planted on the island of St. Vincent, where it is shown with pride today. If this is so, then our No. 11, now scattered about in many yards in South Florida, has a romantic history, whatever else can be said for it.

According to the History of the Royal Society of Arts of London, the first mango ever brought into the West Indies came from Brazil and was called the Guinea, and it is highly probable that this Oriental fruit was taken by the Portuguese missionaries to Brazil sometime in the 17th century.

Between 1898 and 1913 we introduced from India selected lists of their best mangos, and in 1912 Simmonds planted out a little variety orchard in which 80 varieties were grown. The behavior of these was a matter of fascinating interest to us all, for some fruited in the course of a few years and some refused absolutely even to produce a single bloom. These stood as magnificent foliage specimens for twenty-five years and figure in my travel reports of the time as "mules."

What became of all these varieties of mangos? The answer is that they were distributed rather widely through the region and have met a varying fate, just as do most varieties of fruit. Few of the 850 varieties of pear, for example, that were listed by T. W. Field in 1858, could now, I suppose, be found anywhere in the world. It is the fate of varieties to come and go. I could name some introduced mangos, though, which still form a part of our collections in South Florida. There are the Gordon, Julie, Sandersha, Saigon, Cambodiana, Itamaraca, Bennett Alphonse, Pakria, Ameeri, Amini, Lamba Bhadra, Faizan, Rajpuri, Gela, Fajiri Long, Kavas ji Patel, and the gorgeous Borsha, and a good many others, too.

But the native born varieties such as the Haden and Cecil and Brooks have proven in the main more productive, and certainly the Haden is much the most widely cultivated. It is, perhaps, not too much to expect that out of the hybridization which is going on between these various fiberless East Indian sorts will come the Florida mangos of the future.

The romantic story of the Mulgoba mango I have told so often that I shall only allude to it now. Only yesterday I sat on the porch and chatted with Mrs. Haden, to whose husband and to her should go the honor of having raised as a seedling of the Mulgoba mango the famous Haden that is making its way in the great markets of this country and converting the skeptical everywhere to the fact that the mango can be eaten with a spoon, and deserves to rank as one of the most showy as well as most delicious fruits of the entire world.

Robert A. Young holding in his hands a "Trinidad" Dasheen corm that weighed 6/ and 3/4 pounds and was produced in the collection of Dasheens which Mr. Young had charge of at the Brooksville Field Station and from which garden were distributed many thousands of seed tubers of this excellent new vegetable. Taken in 1914.

(Below)

Rows of young Tung Oil seedlings growing in the Brooksville Garden in 1913. One of the numerous blocks of trees that were grown and distributed during the early days when the proper climate and soil conditions were being sought throughout the South.

William Raynes seated on his tall stool with a bottle of wood or tung oil in his hands and samples of the meal he had made from the nuts from the tree beside him.

The tree was in its ninth year when I last saw him on April 2nd, 1914, after several years of interesting correspondence. The tree is the one he rescued from the Tallahassee cemetery.

Dr. John Gifford standing beside one of the very first clumps of trees to be planted out in Florida of the Cajiput tree (*Melaleuca leucadendron*). He was the introducer of this interesting and aggressive tree, which is now spreading rapidly through parts of the Everglades. When in bloom its myriads of flowers make a magnificent sight and attract myriads of bees.

Dr. S. H. Richmond in his clearing at Cutler, Florida, showing, in 1898, a young seedling West Indian avocado tree of which he was especially proud. Dr. Richmond had charge of the distribution of new plants which were distributed among the settlers on the Perrine Grant, the first grant of land ever made by the American Government in aid of agriculture. It is through Dr. Richmond that the sausage tree, now famous, on the road to Cutler, got into the hands of its present owners, Mr. and Mrs. Black.

(Below)

Dr. C. V. Piper (right) the noted student of cover crops whose enthusiastic endorsement of many new introduced species resulted in their being extensively tried. He is standing beside the pioneer, George B. Cellon, in the latter's orchard, which is covered completely with the rank growth of the Yam Bean (*Cacara erosa*). In the early days in South Florida the need of humus in the soil was very acute and the yam bean furnished a large amount of it. It shaded the ground as well. Its tendency to climb the trees was objected to by some growers. Photograph March 25, 1919.

Herbert J. Webber standing beside an Italian Carob tree (*Ceratonia siliqua*) in the little garden on Brickell Avenue in 1898. The garden was then little more than a small clearing in the hammock and Webber was superintending the erection of a little laboratory across the road for which Mr. Flagler had given the money.

This photograph records an exciting moment, for it shows Wilson Popenoe, Agricultural Explorer, holding the fruit of the Itzamna avocado, first of all his collections in Guatemala to fruit in America. Edward Simmonds has just picked it from a branch of the tree behind him into which he had inserted, in 1916, a bud from the bud-stick as soon as it had come in from Popenoe. J. B. Norton, the Plant Breeder, stands discussing with them both its characteristics. This was in March, 1919, and the variety appeared promising then because of its late ripening habit. Since then it has proven to be one of the hardiest of all the Guatemalan avocados grown in Florida.

The Mulgoba mango was introduced by the Division of Pomology of the Federal Department of Agriculture in 1889. Mr. Van Deman was then its chief. My old teacher of horticulture, Prof. Elbridge Gale, who had migrated to Lake Worth in the 80's, was the only man to save the tree, which was sent him by Van Deman, nursing it through two severe freezes at his home at Mangonia. The Mulgoba is still in our collections today, but has refused to bear regularly and is fast disappearing, although its quality entitled it to rank as one of the very best varieties. It is as the mother of the Haden that it will go down into history, for it is from one of a few fruits that Prof. Gale sold to Captain Haden in 1897 that the Haden came. The Cecil is a perfectly delicious sort which found its way into Florida through Cuba. It originated from one of the seeds of 200 fruits of the Philippine mango (a long, golden yellow type) brought in by S. A. Belcher of Miami in 1902 and planted on the place of Cecil Hickson in what is now Coral Gables.

I shall not go farther into this fascinating field, which deserves to be honored by a book, but I cannot close the mango reference without mentioning the name of another pioneer in the mango industry, that of J. W. Barney of Palma Sola. He deserves mention, for like Prof. Gale he immigrated to Florida from the plains of Kansas and became fascinated by the lure of the mango, and he has for forty-odd years grown on his place a variety collection of those sorts sent him from the garden on Brickell Avenue. His "Eleanor," of which he is proud, came from Cuban seed and seems to be unusually productive.

What I have said about the plant studies at the garden does not include any reference to the most excellent pathological work that was done during the years of its existence in the Laboratory which Mr. Flagler built for the Department across the road. The story of the investigation of the insect pests of the mango, avocado and papaya deserves to be treated by such entomologists as Moznette and Mason and, were he only alive to tell it, by Nathan Cobb, who worked for one winter on the nematodes of this region and discovered many new forms of those creatures to which the noisome rootknot nematode belongs.

Perhaps Ernst Bessey, now professor in Michigan State College, might contribute something that would be interesting about the studies of the marine plants and the excursions made by him and his associates at the time when he was at the head of the garden and laboratory. I recall contributing to the running expenses of a launch for the purpose of these excursions and being disappointed when there did not come into existence down here a Biological Station like the one at which I had studied on the Bay of Naples. But perhaps our dreams were too large. Certainly we had not counted on the drift of the masses and the development of Miami into the great health resort it has become.

But of all the men who could tell us of these early days of the little laboratory after Herbert J. Webber left for larger fields of activity, P. H. Rolfs is the one who could tell the most, for he was in charge until he left for Gainesville to direct the State Experiment Station. But, as they say, all this is another story.

I once and only once saw Henry M. Flagler. Mr. Ingraham arranged for Mrs. Fairchild and me to call on him. It was in 1912, almost at the very close of his life. He told me how he had become discouraged when the government proposed to abandon the garden and laboratory and had told Ingraham that as the government seemed to be doinng nothing with it he had better go down and close it up. It gave me real pleasure to assure him that the Plant Introduction Garden which he had helped to establish had been the means of introducing a number of interesting plants and that these plants would develop industries in South Florida after he was gone. He was more interested, of course, in his Overseas Railroad to Key West, his development of trade with Cuba and in the possibilities of sugar cane cultivation on the Everglades. He was first and foremost an engineer, and I have known only a few engineers, W. J. Krome among them, who could take a very keen interest in anything that could not somehow or other be blueprinted; and Plant Introduction is incapable of being reduced to a plan in blue and white.

But back to the "Little Garden." There was a tree of the White Sapote (*Casimiroa edulis*) in full bloom at the corner of the house and I have

a photograph of Mrs. Fairchild holding back the branches so that the flowers could be seen. There was also near by a tree of its cousin, *Casimiroa tetrameria*. I took a fancy to these trees and today, now 25 years later, I have a lot of seedlings of them on my place and am of the opinion that an excellent winter fruit can be evolved by selection and by the crossing of these two species. *Cassia fistula*, the Golden Shower, was a small tree there then, but whether it came from S. P. I. 5469, some seed sent from Honolulu by Prof. Stubbs in 1900 when he was sent to the islands to establish an experiment station there, or through those remarkable young men, Pliny Reasoner and his brother, Egbert, who settled near Manatee in 1882 and founded the firm of Reasoner Brothers, whose name has become a household word among the plant lovers of Florida, I cannot say. In any case, the tree makes a spectacular appearance on the streets of Coconut Grove in spring—unfortunately not every spring—and its glorious golden flower clusters put into the shade the loveliest Laburnum trees that ever flowered in England.

Hearing that Mr. W. J. Krome had started a collection of tropical fruit trees in a clearing in the pines at Homestead, Mrs. Fairchild and I, with Fred Morse of the Model Land Company to guide us, drove down to see it. Mr. Krome was down the line at Marathon directing construction on the Overseas Extension, but his partner, McClure, was there and took us over the raw-looking grove plantings. I see in my journal of the time that he had growing and fruiting the Calamondin. It was the first time I had seen it since I had gotten seeds from a tree of it in Panama, and I felt a proprietary right in it, although later I discovered that Reasoner Brothers had earlier introduced it into Florida. Mrs. Fairchild was pleased to see a bush of the *Astraphaea*, now called *Dombeya Wallichii*, cuttings of which she had gathered from a tree in a public garden in Funchal, whither I was invalided in 1907. It was her first thrill at seeing a concrete evidence of the value of plant introduction about which I had told her so much.

A young sausage tree (*Kigelia pinnata*) had made a tremendous growth in Mr. Krome's yard and I have a photograph of it with myself standing proudly beside it. Years later I once twitted Mrs. Krome over the fact that the whole orchard of tangelos and mangos in which we were all so interested at that time, and over which Mr. Krome spent so many years of hard work, have not yielded so much in the way of cash profits as has the single tree of this same importation of 1907, No. 21203, that stands beside Mr. Black's filling station on the Cutler Highway.

"Krome has two of Swingle's tangelos in fruit and has set out an acre of young plants. He is planning to put out 8 or 10 acres next year. I believe he will make money out of them, although it may be a difficult proposition to get the trade to take up with a new fruit," is the way my Journal runs.

Neither of us had ever tasted a tangelo before and we decided then and there that we preferred it to any orange we had ever eaten in Florida. There was a slight pithiness around the stem end and the fruit colored up before it was ripe, but these seemed minor difficulties then. I fear they have loomed as larger ones since.

Mr. McClure showed us with great pride one of his successful attempts to top graft an old seedling avocado with Trapp scions, and I cherish a photograph of it as the first I ever took of an avocado tree, top worked with a named variety of avocado. Now that there are, let us say, 18,000 acres of groves of the avocado in America, all of named varieties, my tiny photograph has a historic interest for me.

Morse wanted us to see the "Davie Experiment Station" on the Everglades, back of what is now Dania, so we motored out there and saw white mountains of sand and rock that marked the first of the drainage canals. Land was selling along the canal for as high as $125.00 an acre and the land sellers who had financed the Station were talking wildly about the great fertility of the attractive muck and peat soil there. New settlers had come up from the Panama Canal and settled at a spot they named "Zona" and begun to grow vegetables. Vance Helm and some of his associates had secured the services of Robert Werner to conduct the demonstration station on the Everglades land. The "Station" was short lived, however, for when in 1916 Mrs. Fairchild and I visited it again on our way to Miami, the land com-

pany had virtually abandoned it. In less than three days 17 inches of rain fell and flooded the "Station," and for days Werner had to live on Chayotes produced by the vines for which we had supplied the seed. It was a sad sight to see the abandoned plants and I have always regretted that such a start could not have been kept going, for it would have shown many things. For example, to my surprise the citrus trees stood the flooding better than did the bananas and about convinced me that the citrus tribe was a wet land one. We had sent Werner many introduced plants and among them I noticed a row of Cajaput trees (*Melaleuca leucadendron*) from some small plants we had sent him. Through the years that have flown since then, I have periodically visited that row of trees and seen to my amazement the seedlings from it invade and smother the orange trees which were near it and finally cover scores of acres of land with a forest of that Australian tree. But how could I imagine that the time would come when from this forest large trees would be sold to beautify the gardens of millionaires in Palm Beach and Miami, and that the man who first did this transplanting would have his name honored as a discoverer?

Among the interesting plants, and there were many, was one of the Madagascar rubber vine (*Cryptostegia grandiflora*). It had grown amazingly and stood the flooding well. Many years later, when the idea of growing a rubber producing plant on the Everglades was brought up and Alfred Keys was commissioned to get together a collection of the most promising species for this study, I took him out to this same old "Experiment Station," which had passed into the hands of a dentist. He was ripping out every tree and shrub he did not know the name of, and just as a colored man was about to eradicate this Cryptostegia vine, we took a bag full of cuttings from it. It was on one of these cuttings that later on there was produced at Chapman Field the seed of a new and very promising hybrid. I say "promising," but I do not wish to be thought as overlooking the fact that a synthetic rubber is on the market which will make rubber growing a very different affair from what it seemed to be when rubber was selling for 60 cents a pound in Sumatra and Singapore.

Tetrastigma harmandi, S. P. I. 34630, which that intrepid entomologist, C. F. Baker, had sent us from Los Baños in the Philippines, had grown amazingly and was in full fruit after the flood. I have always taken an unwarranted interest in it, but have met rebuffs on every side because of the fact that it grows too vigorously. A vine of it given to Mrs. Wm. Deering grew over her house and had to be cut down because the rats loved the fruit and lived in the vine. At Van Hermann's in Havana, Cuba, it produced a vine a foot through at the base, and only recently my friend, Mrs. George P. Brett, complained that one was going to completely smother her whole place if she didn't cut it out. With all this experience I doubt if anyone has ever tried to make jelly from it or utilize it in the way Baker reported it was used in the Philippines.

Mr. Werner had imported some seeds of a short "leaved" species of Casuarina, *C. cunninghamiana*, which was quite different in appearance from the common species, *C. equisetifolia*, or the species that suckers, which is now called *C. lepidophloia*, although it has never fruited and I suspect it of being a hybrid. *C. cunninghamiana* proved quite hardy in the 1917 freeze and specimens of it are to be seen in many places in Coral Gables and up through the state. Alas, the original trees that Werner planted were killed by a hurricane.

It was on this trip of 1916 that I first met Wm. J. Bryan. He spoke at a little schoolhouse in Ft. Lauderdale and Dr. and Mrs. Bell went with us to hear him. He urged the advisability of an experiment station at Rita, on Lake Okeechobee, and like so many others was "taken" by the dark colored soil of the Everglades. Having seen by that time the millions of ducks and other waterfowl flying back and forth across it, I had formed the idea that it would be a wonderful plan to leave it as a wild bird preserve and allow only licensed hunters to shoot on it at proper seasons, so I was not quite so sympathetic as I might have been to the idea. There seemed to be enough tomato land without interfering with the shore of the largest fresh-water lake in the South.

But I am skipping four years. For I have journals covering 1913, 1914 and 1915 in which are accounts of all kinds of romantic plant happenings.

In 1913 I see that Mr. McMurran, the Plant Pathologist stationed in the little laboratory, had proven that if the mango flowers are sprayed when in flower and repeatedly afterwards, the anthracnose and subsequent spotting of the fruits can be prevented—a procedure which is followed today by those who want spotless fruits.

Then the papaya fruit fly made its appearance and completely baffled us by the destruction of thousands of fine fruit — the maggots, hatching from the hundreds of eggs laid by the fly, forming a swarming mass inside the fruits. For some reason this pest seems not to have stopped the development of papaya growing as an industry and today we have papayas on the Miami market for many months of the year.

By this time the street tree question began to worry the Miami public and seeds from the trees in the little garden on Brickell Aevenue of *Pithecolobium dulce*, S. P. I. 4065, bgean to be planted by nurserymen and householders. It had been the first foreign plant to be planted in the Brickell Avenue Garden, coming from Guymas, Mexico, where it was collected by the well-known plant hunter of Mexico, Dr. Edward Palmer. How it came never to have attached to it its Mexican common name of "Huamuchil" I do not know, but I am glad it didn't. It is perhaps much better that the public of South Florida has come to know these introductions by their Latin names rather than by such vague names as are used elsewhere. I hear that the beautiful flowering tree, *Spathodea campanulata*, for example, is known in the Isle of Pines as "The Rose of Burma." Not being a rose and coming from West Africa and not Burma, the name is hardly appropriate.

Mention of the name Spathodea reminds me to give credit for its introduction to one of our most careful plant enthusiasts, Mrs. Sarah G. H. Jones of Coconut Grove, who brought it in sometime in the early years of the century from Jamaica. Its wide dissemination through the region where today it greets the eyes of thousands of tourists was stimulated by the distribution of many hundreds of plants which were grown from some seeds sent in from Java in 1911 by Dr. Beverly T. Galloway, when he was invalided around the world to recover from a serious breakdown as Chief of the Bureau of Plant Industry. This seed is recorded in the Inventories as No. 31953. This tree was shown to me in the famous Botanic Garden of Buitenzorg in 1895 by its then Director, Melchior Treub, but it did not at that time occur to me to send seeds of it to America.

By 1913 the little garden had become a perfectly fascinating place. There were trees and plants from everywhere and the story of most of them was then fresh in my memory.

Almost within the shade of the first Sycamore fig tree to grow in America, an account of which I gave last year to the Institute, there stood a tree of what a Mr. Longdon of Rhodesia said was the Matondo (*Detarium senegalense*). It was supposed to bear a fruit the size of an apricot and be good to eat, and he sent me one to see what it looked like. The tree grew well and every year I hoped to see it fruit. Once it did bloom and I have photographs of its flowers, but at last I became discouraged, for it simply would not fruit, and gave it up. One day in 1927 I was wandering about near the Water Works at Abuko in the British Colony of Gambia in West Africa, and saw the ground under a tree covered with fruits of what I took to be this same Matondo. I began gathering them to send in and was told to take care, for there was a bitter variety whose fruits looked just like the sweet kind, but which was deadly poison. This gave me pause and I wondered if perhaps it was not quite as well that the tree in the garden on Brickell Avenue had refused to fruit.

Only once in my life have I wished that I had not been quite so brash as to eat the fruits or nuts of the trees about me. This was in the garden which succeeded the one on Brickell Avenue, that at Buena Vista. There were growing in it trees of the Physic-nut, *Jatropha curcas*, the seeds of which I had seen children eating in the Homestead region. My friend, G. N. Collins, was with me and he told me how a man from Mexico had come to Washington to exploit this nut—a delicous tasting thing—and had peddled it among the botanists there. We both tasted them—ate three or four of them, in fact—and later got into our automobile with Dr. Harris of the Carnegie Institution, who had undertaken to show us something on the road to Palm Beach. We had not gone a mile until Collins had to get out. "Nothing

but biliousness. Had a rotten night. Didn't sleep much. Nothing unusual," he said. Before we had gone another mile he got out again. This time we both began to be disturbed and talked about the Jatropha. A third stop and a fourth, and he got out and rolled on the grass. Leaving him in Dr. Harris' care, I started for a doctor up the line. It was Sunday and I couldn't find one and went on and on until I reached Hollywood, where I found one. But for the life of me I could not explain to him what the nut was we had eaten. Finally, after what seemed to me a half hour, light dawned on him and he said, "Oh! That thing? Why my wife nearly died once from eating some of them." He prescribed an emetic and ice and I went to the ice house and waited for a chunk of ice to put on my friend's head, but as I waited I, too, began to feel queer, and that feeling increased as I drove frantically back to where Collins sat on the porch of an abandoned house, his head in his hands, for he was a very sick man. But I, too, was a sick man when I reached him, and it was not until the afternoon had passed and whisky, etc., had revived us that either Collins or I felt like doing anything.

One of the things that interested me in 1913 in that garden was an arbor of velvet beans (*Stizolobium*), for those were the days when this leguminous cover crop was exciting the growers of the whole Southern States and when the easiest way to grow hogs was to plant a field with the rank growing velvet beans and turn the hogs into the field to fatten on the millions of nutritious beans. Dr. C. V. Piper had made a trip to the Oirent and sent back many sorts of this valuable legume, which he did much to encourage, and this was his arbor of them. Some of the introduced kinds like the Lyon and another from China turned out very well, and I recall Dr. Newell once giving me, for purpose of proving the worth of the garden to the Agricultural Committee in Congress, the number of million dollars which they had been worth to the farmers of Florida. I forget the figures now, but they were very gratifying.

The Crotalarias, in which Dr. Piper was also much interested, began to appear early in the little garden, and I see that in 1914 what was then called *Crotalaria madurensis* was being tried there as a cover crop and was producing an amazing amount of humus. I do not find any reference to plants of *Crotalaria striata*, S. P. I. 24119, in those early journals, and I wonder at this, for it was probably there. A German acquaintance of mine, Dr. A. Zimmerman, whom I met at the Carl Zeiss optical establishment in Jena, where he was studying new staining methods for the cell, sent me the first seeds of this species. He had become the head of the Agricultural Institute at Amani, German East Africa, and sent me a collection of seven leguminous species which he was testing there. This was in 1908.

Crotalaria spectabilis I believe came in later from the Punjab, India, through Thomas W. Brown, then in Egypt. At least S. P. I. 51839, in 1920, is the first reference to it which I find in the Inventories. But I am invading historical territory which has been covered by my friends, Stokes and Pieters, the former of whom has spent years of study of these remarkable soil improving crops. I never pass an extensive field of Crotalaria, with its gorgeous yellow blooms shimmering in the sunlight, but my mind wanders to the little garden on Brickell Avenue where I first saw them in bloom; and it brings to my mind Piper's last visit to Miami and his enthusiasm over the future possibilities of the Everglades, when Para and Carib and Japanese cane should have become established there. He had made an expedition to the Orient after forage crops and took a lively interest in the patch of Kudzu which we had established back of the garden and which threatened to drive our neighbors out. This plant was not looked upon with favor by the "experts," and Mr. C. E. Pleas of Chipley, who almost with fanaticism boosted it, was considered something of a visionary. I wonder what the verdict would be today? As I had been enthusiastic over the Kudzu ever since seeing it in Japan in 1902 and had it growing on my place in Maryland, I wanted so badly to talk with Pleas that I dragged him out of his bath tub one night as I was travelling through, to tell me about his experiments at Chipley. The memory of that incident came back recently as I stood in a field of Kudzu at Cairo, Georgia, and heard its value extolled by Mr. J. B. Wight. But mingled with those memories comes the picture of how the vine

climbed over a precious White Barked Pine which Frank Meyer had brought from China and which was growing in my yard at "In the Woods," near Washington. After trying for years to establish it and succeeding, I spent years of unsuccessful effort to eradicate it. It was only after we sold "In the Woods" and the new owner pastured his cow in the yard and kept it browsed down, that it disappeared.

But there was another cover crop in the little garden which excited Piper's admiration, and I took him to see it in action on the place of George B. Cellon. This was the Yam Bean (*Pachyrhizus [Cacara] erosus*), S. P. I. 33258, which came to us from Jamaica in 1912. Only the other day Cellon said to me, "That was a great crop for orchards, once it got established, for a single tuber forty pounds in weight would form in the center of the square and the vine come up every spring and cover the ground completely without bothering the trees."

One little tree from Brazil, the Jaboticaba (*Myrciaria cauliflora*), I must mention. It was 23431 and came from Dr. Bello of Rio, whose acquaintance I had made there in 1899. He sent a number of grafted plants of the Itamaraca mango to me in 1908 and with them some plants of this strange but delicious fruit tree of which the Brazilians are inordinately fond. I speak of this fruit tree because the very specimen that I first saw leafing out on March 27, 1914, was completely hardy and came through the great freeze of 1917 without being injured, and it is this one which has given us the faith to proceed with a new program of its dissemination. Our expedition to Brazil, made by P. H. Dorsett, Wilson Popenoe and A. D. Shamel in 1914, brought back amazing photographs and much material of this new, somewhat hardy fruit tree which deserves to find a place in the dooryards of Florida, and of which there is a fine fruiting specimen here in Winter Haven. See Occasional Paper No. 2, Fairchild Tropical Garden, for a full account of this introduction.

In the spring of 1914 it was decided to enlarge the garden facilities, since the six-acre tract under lease from Mrs. Brickell had become totally inadequate. My friend, O. F. Cook, came with me and we made a thorough search for new sites. Of course, we hadn't a cent of Government money with which to buy land, so we had to depend upon the generosity of private individuals to give us a site. We were modest. We only wanted 25 acres. That seemed a lot then. At first Mrs. Brickell said she would give us a site and we even had it surveyed. But she changed her mind and would only lease it to us. Then other properties were offered, by George Merrick, and Carl Fisher, and Dr. Du Puis, but they were either too far out of town for our bicycle-riding investigators and visitors, or had unsuitable shell-sand soil. Finally Mr. Charles Deering, who had a large tract on the Bay at Buena Vista, came forward and offered us 25 acres, "to be used by the Department for a Plant Introduction Garden as long as it wished to and then to revert to his estate." On this we started with our slender funds, landscaping it according to the ideas of the great landscape gardener, Mr. O. C. Symonds of Chicago, who was doing Mr. Deering's own estate in such splendid style.

I cannot look back to those days without emotion, for our plans were so perfect. Everything was set for what we thought would be a great garden. And across the wall was the beautiful place which at that time Charles Deering had dreams of making into a large arboretum. Alas! we had neither of us figured on the encroachments of a populous city or the insistent demands of the city commissioners for straight streets with which to reach the "new developments."

After a few years of life in a kind of a fools' paradise the whole dream collapsed when the 1925 boom struck the town, and today only a few introduced trees remain to mark the spot where our dream was located. Immense beautiful trees were torn out by the roots with tractors, and Mr. Deering's "arboretum-that-was-to-be" was laid waste and allowed to grow up to weeds when the boom burst.

It is true that between 1914 and 1923—nine years—much was done on this Buena Vista Garden, as we called it. In fact, the Popenoe collection of avocados was established there, and a choice collection of Annonas was planted and also one of Garcinias—relatives of the Mangosteen.

An attractive avenue of the Sycamore fig tree led into it and the test nursery contained a most interesting collection of new introductions. The Tropical Jujube (*Zizyphus mauritiana*) first fruited in this country there, and the thousands of bearing trees of this still undeveloped fruit tree that one sees now all over South Florida came from the trees planted at Buena Vista. In Avon Park a citizen I met insisted it was the "Jay-Pan Apple." Also that curious shrub from the Comoro Islands, off the coast of Zanzibar, *Psychotria bacteriophila*, characterized by having bacterial nodules in its leaves, was first tried out there. Today it is slowly invading my hammock in The Kampong and calling for a wider trial in the hammocks of the State.

Professor Simpson of Little River, with the publication of whose first book Mr. Deering and I had been associated, took a keen interest in everything connected with the new garden and made out a list of all the native plants which it contained for purposes of historical reference.

Then came the great freeze of 1917, the first serious one to visit the gardens since there were enough introductions in them to make it matter much. It occurred on February 3.

The Tamiami Trail had been built out only ten miles from Miami then, and my friend, Mr. Lathrop, Prof. Simpson, Dr. W. E. Safford and I had spent the day of February 2 there botanizing in the beautiful hammocks that were then on both sides of the Trail—hammocks that are, alas, no more.

The temperature began to drop as we returned and Ed Simmonds remarked that we might look for cold weather next day. As Mrs. Fairchild and I had acquired The Kampong in Coconut Grove the fall before, I was more than merely interested—I was much concerned, when next morning I found a large crab in its death throes near my porch and a fruit jar down at the barn half full of water with ice crystals formed in the upper half inch or so.

I hurried to the garden. There was Simmonds watering the mangos to keep them from thawing out too rapidly. "Like two men at a funeral we wandered about among the plants. The papayas were black, with their fruits covered with masses of papain that had oozed out," is the way the report stands in my Journal.

I decided to go over the whole garden and take photographs and notes of every species in it for future reference in later years, but before anything was done hurried to the "New Garden" at Buena Vista to see how things had fared there. The sight was a blow, for the appearances indicated in no uncertain terms that our new site was colder than the old one. The avenue of young Sycamore figs was cut to within a foot of the ground and the whole collection of Annonas, with the exception of *Annona diversifolia*, had been killed to the ground. The temperature recorded in the little garden was 26.5° F., and in the larger one, where unfortunately there was no self-registering thermometer, it probably went to 25° F.

Since I have just written a bulletin for Dr. Hume that covers the observations of that period and also of the freeze of 1934, and given all of the data at my disposal for those who want to know how much cold their plants can stand, I will pull down the curtain on these sad days of 1917 at the gardens, remarking only that we found the response from the freeze much quicker and more complete than we had expected and learned which were our hardy and which our most tender species. The album of frosted plants which I made at that time, and which was hand colored to show what color changes the plants underwent, is still one of my most interesting volumes.

As by 1914 a special Bamboo Garden had been established by the Office near the little town of Brooksville, because the Japanese and Chinese timber bamboos were unsuited to cultivation in South Florida, my attention was divided between it and the Miami Gardens.

Not only did we do our bamboo work at Brooksville, but the Dasheen and Chayote work as well, and for several years my colleague, Robert A. Young, carried out one of the most intensive attempts ever made to introduce two new and delicious vegetables, the Dasheen and the Chayote, both of which are today on the market in a small way. Had I the time to digress I would like to tell of the many vegetables we tried out at Brooksville, where the conditions for such work were better than here.

The bamboos were transferred to Savannah, Georgia, and formed the nucleus of the Bamboo Garden there, and to my great regret the Brooksville Station was abandoned.

Furthermore a large plant garden was being developed in California and filling up with new plants, and the activities in Washington had so multiplied, due to the Great War, that it was not until 1920 that I again was able to visit the gardens on Brickell Avenue and at Buena Vista. By this time the mango collection had begun to bear and show how varied that species is in its colors and fiberlessness and flavor. I was proud of these gardens and showed them to my old friend, Barbour Lathrop, who by this time had come to be known as the Patron Saint of Plant Introduction, and am sure he felt that his generosity towards the work had not been in vain. Rows of seedling Mexican, Guatemalan and West Indian avocados were being tested side by side with Popenoe's introductions, which by this time had been placed at Lucern and other places, and I was able to check up on the congeniality of the various varieties to the stocks they were on. Some of the imported varieties were persistently uncongenial to both seedling Guatemalan hybrid stocks and to West Indian stocks as well.

Some new and promising shade trees had come on the scene and begun to be planted along the streets, such as the *Pongamia pinnata* from the Philippines (which when headed high and trained up makes a beautiful street tree) and the *Terminalia arjuna* from British India, together with the Bo tree of Ceylon, *Ficus religiosa*, and an occasional specimen of *Syzygium cumminii*, the Java Plum, not to mention a whole series of Cassias with beautiful pendant flower clusters, and the *Acrocomia sclerocarpa* palm and that loveliest of blue flowering shrubs, the *Guaiacum officinale* or Lignum Vitae. The *Holmskioldia* vine with its soft red flowers that Popenoe had brought with him in his cabin from India had begun to be seen about the yards, and the general public had commenced their pilgrimages to Prof. Simpson's hammock in such earnestness that they almost wore him out.

The craze for Coconut Palms was at its height, and Hugh Matheson had worked out the technique of transplanting large specimens which he was able to transport across Biscayne Bay from his plantation of 35,000 palms there, many of which had attained large size. This was shortly before the Mathesons and our Section of Plant Introduction negotiated a cooperative introduction of Malay Dwarf Coconuts from a Mr. W. P. Handover of Port Dickson, Federated Malay States, consisting of 622 nuts. From this shipment have come the beautiful golden-yellow fruited coconut palms which are to be seen in the dooryards of the Miami region. Not all of them by any means remained dwarf, but they retained in part at least the golden color of the fruits. Of the bud-rot scare which attended this introduction and the anguish it caused I would rather not say anything here.

In 1920 the population of Miami had grown from the few hundred inhabitants which were here in 1898, when I first visited it, to over 38,000, and houses had been built all around the New Garden at Buena Vista, and I began to realize that 25 acres would be totally inadequate to contain the trees and the various activities of a Federal Garden which was being fed by the tropical explorers of the Section (which had by this time become an "Office") at the rate of several thousand new introductions a year.

Something would have to be done. I knew there was a large tract of land which the War Department had bought during the war for an air training field and which it was going to sell. Mr. Simmonds and I had inspected it and decided that with all its faults (for it resembled rather too closely a rock pile to please us and had an area of salt land that might be difficult to tame), it had one indispensable advantage over other tracts. It was near the bay and its climate was tempered by the breezes from off the Gulf Stream.

The Hon. John Weeks was Secretary of War at the time and I heard he was in Miami, and on March 7 I called upon him and presented my case. He seemed interested, for he had ridden over the country 38 years before, when it was a wilderness, and had lived for years in Ocala. We talked for half an hour and he told me how as a boy he had seen his father make a trench and bury his grapefruit in it because there was no market for grapefruit then. He assured me that he was not in favor of selling Chapman Field and that he saw

no reason why he should not give the Secretary of Agriculture a revocable license for its use. But the Secretary changed his mind upon his return to Washington and I saw it announced in the papers when I got back there that Chapman Field was up for sale. Through my old friend and collegemate of Kansas days, General James G. Harbord, then Chief of Staff, I appealed for a hearing with the Secretary, and armed with my big album of frosted plant photographs depicting the effects of the freeze of 1917 and accompanied by Wilson Popenoe, then our Tropical Plant Explorer, I waited in Mr. Weeks' anteroom. He explained that he had been told that there was any amount of good land which the Department of Agriculture could have for the asking and that the Army needed the money for rehabilitation purposes.

But when I explained that I was searching for a piece of Climate, and that General Squires in buying that tract for the Army had happened to take one of the most nearly frostless tracts of any size in the whole State of Florida, and showed him the album, he remarked, "What? Frost in the Miami region? I thought it was frost free. They told me it was." Then leaning back in his chair he said, "I'll tell you what I will do. I'll give you a revocable license on the whole tract of 800 acres and that will afford you, as I figure it out, five years to prove whether you are worthy of having it or not. For I shall be here for three years more and any successor would hardly get around to take any action inside of two years after taking my place." I was bitterly disappointed for, child as I was in such matters, I thought he could give the land outright to the Department of Agriculture. He had not the power, unfortunately, and during my absence on the other side of the world some citizens of Miami who were as air-minded as I am plant-minded chiselled away from us all but 95 acres which was secured permanently by an agreement bearing President Coolidge's signature. Later the War Department allotted 65 more acres for rubber work.

But something else quite unusual happened in February, 1922. Mr. Allison V. Armour anchored his houseboat at Mrs. Brickell's pier on the Miami River and called at the garden on Brickell Avenue. He invited me to dinner and over the coffee we talked of exploring for plants. He said he would buy a boat and equip it and set out for plants if I would go with him. Quite naturally I agreed to go and in October of 1924 set out with the whole family for Europe, as described in a book which Mrs. Fairchild and I later published.

The great boom came to Florida the year following and laid paved sidewalks miles and miles out into the country, and then it burst. Following it came the great storm of September 18, 1926, which poured three feet of salt water over the little garden and almost completely wrecked it. We had returned for a short stay in America and rushed down from Washington to see what had happened, and were met by a spectacle of desolation which words cannot describe. The garden on Brickell Avenue had been wrecked, and whereas "fragments" of it were saved and transplanted to the white, barren-looking, rocky land with its rock pits which composed the new garden at Chapman Field, its charm was gone. Mr. and Mrs. Simmonds, who had barely escaped with their lives, set to work to save what they could, and from its wreckage there has grown a new and a larger and I trust a better garden of introduced plants. It can never have the romance for me which the little garden on Brickell Avenue had, but I suppose that is a small matter anyhow.

And now as the shadows begin to lengthen in my life, the heading of a new chapter of plant introduction has been written. I refer to the ceremonies that took place south of the Matheson Hammock on March 23 which officially dedicated the Tropical Botanical Garden which my friends have done me the honor of naming after me.

I did not mean to bring up this matter in quite such detail here. It is so close to my heart, however, that I cannot get away from it.

MAGNESIUM DEFICIENCY IN RELATION TO YIELD AND CHEMICAL COMPOSITION OF SEEDY AND COMMERCIALLY SEEDLESS VARIETIES OF GRAPEFRUIT

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INTRODUCTION

In 1934 a study was begun of the fruit, seed and foliage composition of Duncan, Excelsior, Walters and Marsh grapefruit. The trees, budded on rough lemon rootstock, were planted in 1925 and came into production in 1930. The fertilizer programs for the four varieties have been the same since the trees were set. At the present time the Marsh trees are larger, more vigorous and possess more abundant foliage than the trees of the seedy varieties. Likewise, Marsh has produced larger crops in each of the three years that this study was made.

The foliage on trees of seedy varieties which are producing heavy crops begins to "break" in color about the middle of August. The bleaching of the green color becomes more and more accentuated until the leaves are practically devoid of green pigment except for a pyramid of green extending from the base of the leaf up along the midrib. In severe cases this green area disappears. Thus, the observations made during the three years indicate that the various greenish-yellow patterns observed are progressive stages leading towards the complete bleaching of the green color in the leaves. Apparently this bleaching process reaches a maximum about November first. After several weeks in this condition the leaves begin to drop and severe loss of foliage results. The fruit will persist on these defoliated limbs for a time and then drop. More often than not the weakened limb will die back to a point well within the canopy of the tree. The loss of green color and subsequent loss of leaves is commonly referred to as "crop strain." The trees of the Marsh variety are conspicuously free from the above condition, as are trees of seedy varieties not bearing a crop. The greenish-yellow leaf patterns of this type are being specifically referred to as "bronzing," and this term will be used throughout this paper in referring to the condition. The type of bronzing produced in this grove is similar to type B described by Bahrt and Hughes (1).

The object of this study has been to find in the composition of fruit, seed and leaves an explanation, if possible, for the differences in the behavior of seedy and seedless varieties of grapefruit.

SEED PRODUCTION

In order to determine the relative number of seeds produced and to obtain adequate seed material for analysis, 100 fruit, size 70, were selected of each variety. After weighing these samples, the seed were carefully removed, counted, cleaned with dilute alcohol and weighed. The data of Table I show the physical aspect of seed production. The mean number of seed per fruit of the three seedy varieties varied from 45.5 to 55.6 as compared with only about 3.0 seed per fruit for Marsh and constituted about 2.4 per cent. of the weight of the seedy fruit and 0.18 per cent. of the Marsh.

The difference in seed production between seedy and seedless varieties is apparently basic to any explanation for the wide variation in the growth and yield responses of these varieties under common field conditions. The production of seed is often accompanied by appreciable translocation of food from leaves and stems of the plant to the fruit and seed. Unquestionably translocation is a big internal process in citrus and especially in seedy varieties of grapefruit which tend to produce the fruit in clusters. The Walters variety shows the greatest mean number of seed per fruit. It is interesting to note that Camp and Jefferies (2) found Walters to be the least responsive of the four varieties as indicated by yield and growth records. They found that this particular strain of Walters does not fit the orig-

TABLE I

A COMPARISON OF SEED PRODUCTION IN SEEDY AND COMMERCIALLY SEEDLESS VARIETIES OF GRAPEFRUIT

	Duncan	Excelsior	Walters	Marsh
No. of Fruit Used	100	100	100	100
Fresh Wt. of Fruit (gms)	52537.0	51688.0	50540.0	50717.0
Fresh Wt. of Seed (gms)	1250.0	1238.0	1289.5	91.65
Dry Wt. of Seed (gms)	629.0	669.1	682.1	43.85
No. of Seed in 100 Fruit	4745	4502	5522	304
Mean No. Seed per Fruit	47.80	45.55	55.65	3.04
Fresh Wt. Seed per Fruit (%)	2.38	2.39	2.55	0.18

inal description of the true Walters variety, however.

In order to reduce the volume of material for this paper, the data for the three seedy varieties have been averaged and the discussion will be based on the averaged data of seedy varieties as compared with the commercially seedless Marsh variety.

COMPOSITION OF WHOLE FRUIT AND SEED

The term "crop strain" indicates that the supply of elements and organic foods are somewhat inadequate for the production of fruit to maturity and at the same time maintain a healthy tree condition. The analyses of whole fruit are given in Table II to show the comparative nitrogen and mineral requirements of seedy and seedless grapefruit. The percentages of dry matter, total nitrogen, ash and all mineral elements determined, with the exception of aluminum, are higher in seedy than seedless fruit. Although the differences are small, they will, when expressed as a function of the dry matter, reflect significant differences in a given quantity of seedy and seedless fruits as will be shown presently.

The analyses of the respective seed given in Table II show that seed of seedy varieties are higher in dry matter, ash, potassium and magnesium, and lower in calcium and iron than seed of Marsh. The other elements vary only slightly. Here again the differences in percentage composition are small. However, when these data are calculated to show the total amounts of these elements in the seeds of the respective fruits, the differences become very great because of the much greater quantity of dry matter due to the greater number of seed in seedy fruit. In the light of the seed composition, the differences observed in the whole fruit composition is partially due to the difference in quantities of seed present. The high percentage of dry matter in seeds indicate that they are largely storehouses of organic food for the young embryos. This is further indicated by the fact that the per cent. total nitrogen, phosphorus, magnesium, iron and manganese are approximately double that of the corresponding whole fruit. The per cent. total ash in seed is much lower than in whole fruit. The seeds are lower in potassium, calcium and aluminum than the whole fruit. This change in the ratio of the minerals found in the seed as compared to the ratio in whole fruit indicates that the seeds exert a selective absorption of minerals. The low ash content of seeds may be the result of the large reduction in potassium and calcium which constitute 45 to 50 per cent. of the total ash of whole fruit.

In order that a comparison may be made of the composition of a unit quantity of fruit, the data of Table III have been compiled to show the quantities of the principal elements removed from the tree in 100 whole fruit, size 70, and the amounts of these elements removed in the respective seed. The data of Table I and the percentage composition data of Table II were used as a basis for this computation. Although the fresh weight of seedy fruit is slightly larger, it is small as compared with the differences in dry weight and in the elements determined. The percentage differences have been presented merely to show that the difference in initial fresh weight is not responsible for the differences in the quan-

TABLE II

A COMPARISON OF THE FRUIT COMPOSITION OF SEEDY AND COMMERCIALLY SEEDLESS VARIETIES OF GRAPEFRUIT WITH THE COMPOSITION OF RESPECTIVE SEED

	Type	Dry Matter	Total N	Total Ash	Per Cent. of the Dry Matter						
					P	K	Ca	Mg	Fe	Al	Mn
Whole Fruit	Seedy	11.23	1.113	5.450	0.1485	2.058	0.572	0.119	0.0058	0.0042	0.00055
	Commercially Seedless (Marsh)	9.63	0.950	4.531	0.1288	1.711	0.458	0.103	0.0036	0.0057	0.00041
Seed	Seedy	52.34	2.44	3.001	0.2761	0.918	0.295	0.1983	0.0129	0.0004	0.0008
	Commercially Seedless (Marsh)	47.85	2.48	2.769	0.2838	0.760	0.339	0.1875	0.0235	0.0006	0.0008

TABLE III

A COMPARISON OF THE QUANTITIES OF THE PRINCIPAL ELEMENTS CONTAINED IN 100 WHOLE GRAPEFRUIT (SIZE 70) AND THE AMOUNTS OF THESE ELEMENTS CONTAINED IN THE RESPECTIVE SEED

	Type	Fresh Weight	Dry Weight	Grams per 100 Fruits					
				N	P	K	Ca	Mg	Mn
Whole Fruit	Seedy	51588.3	5793.4	64.4943	8.6177	119.3253	33.0339	6.8890	0.0322
	Commercially Seedless (Marsh)	50707.0	4883.1	46.3895	6.2894	83.5493	22.3646	5.0296	0.0200
Percentage Difference as compared with Marsh		1.74	18.64	39.02	37.01	42.81	47.70	36.96	61.00
Seed	Seedy	1259.2	660.1	16.1257	1.8218	6.0597	1.9471	1.3087	0.0053
	Commercially Seedless (Marsh)	91.7	43.9	1.0875	0.1244	0.3333	0.1487	0.0822	0.0004
Whole Fruit minus Seed	Seedy	50329.1	5133.3	48.3868	6.7960	113.2655	31.0868	5.5803	0.0269
	Commercially Seedless (Marsh)	50615.3	4839.2	45.3020	6.1650	83.2165	22.2159	4.9494	0.0196
Percentage Difference as compared with Marsh		—0.57	6.08	6.81	10.24	39.93	39.93	12.75	37.24

tities of these elements removed. The data show that the quantities of these elements removed in 100 whole fruit is much greater in seedy varieties than in Marsh, the percentage increases as compared with Marsh varying from 37 to 60 per cent.

Of these total quantities removed in whole fruit of the two types, the quantities removed in the respective seed are presented to give a measure of the effect of seed production in relation to these elements. It is obvious that the large difference in the dry matter of the seeds of seedy varieties is due to the difference in the number of seed produced—there being about 15 times as many in seedy fruit—and not to any large difference in the percentage composition of the seed. In fact, the values obtained by multiplying the quantities of the elements found in Marsh seed by 15 approximately equal the quantities in the seed of seedy varieties.

Subtracting the quantities of those elements contained in the seeds from the whole fruit gives the amounts of the elements in the pulp and rind of the fruit. The results show that fruit of seedy varieties, after the exclusion of the seed, still contain greater quantities of these elements than Marsh. However, the differences have become greatly reduced. For instance, the difference in nitrogen is of the same magnitude as the difference in dry matter. Phosphorus and magnesium differences have been reduced to one-third the original and manganese to one-half. Potassium and calcium have not been greatly reduced because the seed requirement of these two elements is comparatively low. These results, in so far as high mineral composition may be a factor, indicate that the food value of seedy fruit is superior to that of Marsh. Although the amount of magnesium removed in fruit is small as compared with nitrogen, potassium and calcium, and of about the same magnitude as phosphorus, it may very likely become the "limiting element" where the soil supply is low and where it is not being added in the fertilizer.

COMPOSITION OF FOLIAGE IN RELATION TO BRONZING

In October of the 1936-37 heavy crop year the trees of all three seedy varieties were showing extreme effects of what has been called "crop strain." The discoloration or bronzing of the foliage on a particular limb, as already described, was definitely associated with the amount of fruit being produced. The more abundant the fruit, the more complete had become the bleaching of the green coloring matter. Samples of green and bronzed leaves were collected and analyzed, the green leaves being taken off limbs of the trees which were not bearing fruit. In the case of Marsh which has not produced bronzed leaves, the analogous samples were taken "near the fruit" and "away from the fruit." The object of the analysis was to determine the effect of crop production and the change in composition of the foliage resulting from bronzing.

The results of these analyses are shown in Table IV. In every case the green leaves contain slightly more dry matter than the analogous bronzed leaves. An important point about these data concerns the total nitrogen which is very significantly higher in the green leaves of all varieties as compared with bronzed leaves or leaves near the fruit as in the case of Marsh. In this connection, leaf sap analyses (unpublished) show the opposite condition; namely, the bronzed leaves contain more nitrogen in the sap. This high soluble nitrogen is associated with a low total nitrogen in the leaves. This condition is construed to mean that the production of fruit, and especially the production of large quantities of seeds, is drawing upon the leaf nitrogen to satisfy the requirements.

The per cent. total ash shows no definite relationship to leaf condition. This may be due, as is apparent from the data, to some elements being high in green leaves and others high in bronzed leaves. Amounts are too small to be significant as is indicated by the percentage differences which show the magnitude of the quantities in bronzed leaves as compared with green leaves. Phosphorus is much lower in leaves near the fruit regardless of whether or not they are bronzed. This indicates that phosphorus is not a factor in producing the bronzed foliage although it is materially reduced in leaves in the vicinity of the fruit. Thus, the green leaves of Marsh near the fruit are just as low in phosphorus as the bronzed leaves of seedy varieties.

TABLE IV

A COMPARISON OF FOLIAGE COMPOSITION OF SEEDY AND SEEDLESS VARIETIES OF GRAPEFRUIT AND THE CHANGE IN COMPOSITION WHICH OCCURS WITH CHARACTERISTIC BRONZING OF THE FOLIAGE IN LATE SUMMER AND FALL AND WHICH IS COMMONLY REFERRED TO AS "CROP STRAIN"

	Condition	Dry Matter	Total N	Total Ash	Per Cent. Dry Matter						
					P	K	Ca	Mg	Fe	Al	Mn
Seedy	Bronzed	34.90	1.71	14.430	0.106	3.259	3.639	0.015	0.027	0.0097	0.0026
	Green	37.21	2.19	14.504	0.124	2.623	4.039	0.169	0.022	0.0070	0.0035
Percentage Difference		−6.21	−21.92	−0.51	−14.52	24.25	−9.90	−91.12	22.73	35.58	−25.71
Marsh	Green*	36.00	1.92	14.098	0.104	2.805	3.564	0.122	0.019	0.0072	0.0028
	Green	36.30	2.23	13.985	0.131	2.707	3.589	0.228	0.018	0.0090	0.0033
Percentage Difference		−0.83	−13.90	−0.81	−20.61	3.62	−0.70	−46.49	5.56	−20.00	−15.15

*Leaves near fruit.

The behavior of potassium is opposite to that of phosphorus; that is, the bronzed leaves and Marsh leaves near the fruit are higher in potassium than green leaves away from the immediate influence of fruit production. The bronzed leaves of seedy varieties show a particularly high potassium content as compared with green leaves. This is not construed to mean that high potassium is the cause of bronzing. The probable explanation is that the selective removal of other elements and organic materials from bronzed leaves causes the potassium to appear as a higher percentage. For instance, the increase in potassium is almost the exact counterpart of the dedecrease in calcium. The fact that potassium, being the highest ash element in whole fruit, is not being reduced in leaves near the fruit indicates that it is not a deficiency factor in the production of crop strain or bronzing. It has been found from sap analysis that 70 to 100 per cent. of the total potassium is in solution—the soluble phase. Since potassium has never been found tied up as a part of any organic compounds in plants, it may be considered to possess the ability to move directly through the conducting system and into the fruit without passing through the elaborating leaf mechanism. If this assumption is true, it would become possible to explain the lack of a reduction of potassium in leaves near fruit in spite of the high content of potassium in the fruit.

The calcium content of bronzed leaves is about 10 per cent. lower than that in analogous green leaves of seedy varieties. The variation in Marsh is considered insignificant. The calcium content of leaves is highest of all ash elements, whereas, in whole fruit the potassium content is highest.

The greatest significant difference found in any of the elements thus far determined is that of magnesium. The green leaves of seedy varieties contain 10 to 15 times more magnesium than the analogous bronzed leaves. Even the Marsh leaves near the fruit which do not lose their green color contain about one-half as much magnesium as the green leaves away from the fruit. Also, the Marsh leaves near the fruit contain almost as much magnesium as the green leaves of seedy varieties away from the effect of crop production. The largest amounts of magnesium were always found in Marsh leaves located away from the effects of fruit production—this quantity perhaps is none too high.

Iron and aluminum are slightly higher in bronzed leaves of seedy varieties. The differences are probably not significant in the Marsh. Manganese is consistently higher in the green leaves of all varieties that are not influenced by the fruit. The amounts of manganese in bronzed leaves and Marsh green leaves near the fruit is of the same magnitude. Therefore, these differences do not indicate that manganese is an important factor in bronzing. Obviously, to what extent the three elements just mentioned may appear as limiting factors in the nutrition of these grapefruit varieties depends upon building the magnesium supply to a point where it is no longer the primary limiting factor. The same is perhaps true of all the mineral elements in their practical application.

It has become apparent from the data for whole fruit, seed and foliage composition already presented that magnesium is very closely associated with the bronzed leaf condition. The ratios of calcium, which has not been found to fluctuate widely, to magnesium which has been associated directly to bronzing are given in Table V. The results are given for each of the four varieties. The ratios are approximately 5.0 to 1 in whole fruit and 1.5 in seed. No significance is attached to the observed variations in the whole fruit and seed ratios since these have been found to vary somewhat from year to year. The narrow ratio in the seed has been accomplished by a reduction of calcium in the seed dry matter on the one hand and a sharp rise in magnesium on the other when compared with the whole fruit composition. A comparison of the ratios of green and bronzed foliage of seedy varieties shows the very great differences that exist. The high ratio values of bronzed leaves of seedy varieties are not due to an increase in calcium—the data (Table IV) indicate calcium decreases in bronzed leaves—but to pronounced decreases in the magnesium content. The foliage of Marsh Seedless taken in the proximity of fruit does not show the wide ratio found in the leaves of seedy varieties. In fact, the ratio in the Marsh leaves (29.2) near fruit is of about the same magnitude as

TABLE V

THE RATIO OF CALCIUM TO MAGNESIUM, Ca/Mg, IN THE WHOLE FRUIT, SEED AND FOLIAGE OF FOUR VARIETIES OF GRAPEFRUIT

		Ratio: Ca/Mg			
		Whole Fruit	Seed	Foliage	
				Bronzed	Green
Seedy	Duncan	4.41	1.41	210.1	26.3
	Excelsior	5.26	1.56	273.6	18.5
	Walters	4.75	1.49	299.0	29.1
Commercially Seedless	Marsh	4.45	1.81	29.2*	15.7

*Marsh foliage not bronzed.

those of at least two of the three seedy varieties representing green leaves located away from the influence of fruit. The point of a deficiency of magnesium in the leaves in relation to crop production is apparent from these ratios. Obviously the production of large quantities of seeds in seedy varieties is one of the factors augmenting the deficiency.

Since the most pronounced expression of the effects of crop strain is bronzing of foliage, the averaged composition of bronzed and green leaves of seedy varieties are compared as per cent. differences with the composition of Marsh foliage. Since Marsh does not show the leaf symptom of bronzing it may be used as a base for comparison. The comparison is shown in Figure 1 in which the variation in the composition of leaves of seedy varieties are referred to the composition of Marsh leaves. Quantities of these elements in leaves of seedy varieties of more than plus or minus 10 per cent. are considered significant variation from Marsh composition. The composition of Marsh leaves "near the fruit" as well as that of Marsh leaves "away from the fruit" is represented by the straight line drawn through the zero point. The percentage differences found in the composition of the analogous leaves of seedy varieties are shown as plus or minus quantities, depending upon whether a particular element is greater (+) or smaller (—) than that in Marsh leaves. The first column of each pair represents the percentage differences shown by bronzed leaves, the second column, the differences shown by green leaves of seedy varieties.

Potassium in bronzed leaves and calcium in green leaves are the only elements in leaves of seedy varieties that show a percentage difference greater than a plus 10 per cent; whereas, nitrogen in bronzed leaves and magnesium in bronzed and green leaves of seedy varieties are significantly lower than in Marsh leaves. The large deficit of magnesium in the leaves of seedy varieties, especially bronzed leaves, overshadows the variations of all other elements determined. The green leaves of seedy varieties contain approximately 25 per cent. less magnesium than green leaves of Marsh. This indicates that trees of seedy varieties are becoming depleted of magnesium as a result of crop production since 1930 when they reached bearing age. The magnesium content of bronzed leaves is 87 per cent less than the amount in Marsh leaves near the fruit.

Thus, without entering into long time experiments whereby the response of these varieties of grapefruit to applications of magnesium is measured, it has been possible to demonstrate by symptomatology and by comparison with Marsh as a base that the shortage of magnesium is the cause of bronzing in seedy varieties.

Time will not permit here a discussion of the relation these data have to mean yields and alternate bearing both of which are closely related to magnesium deficiency and to the physiological effect of bronzing.

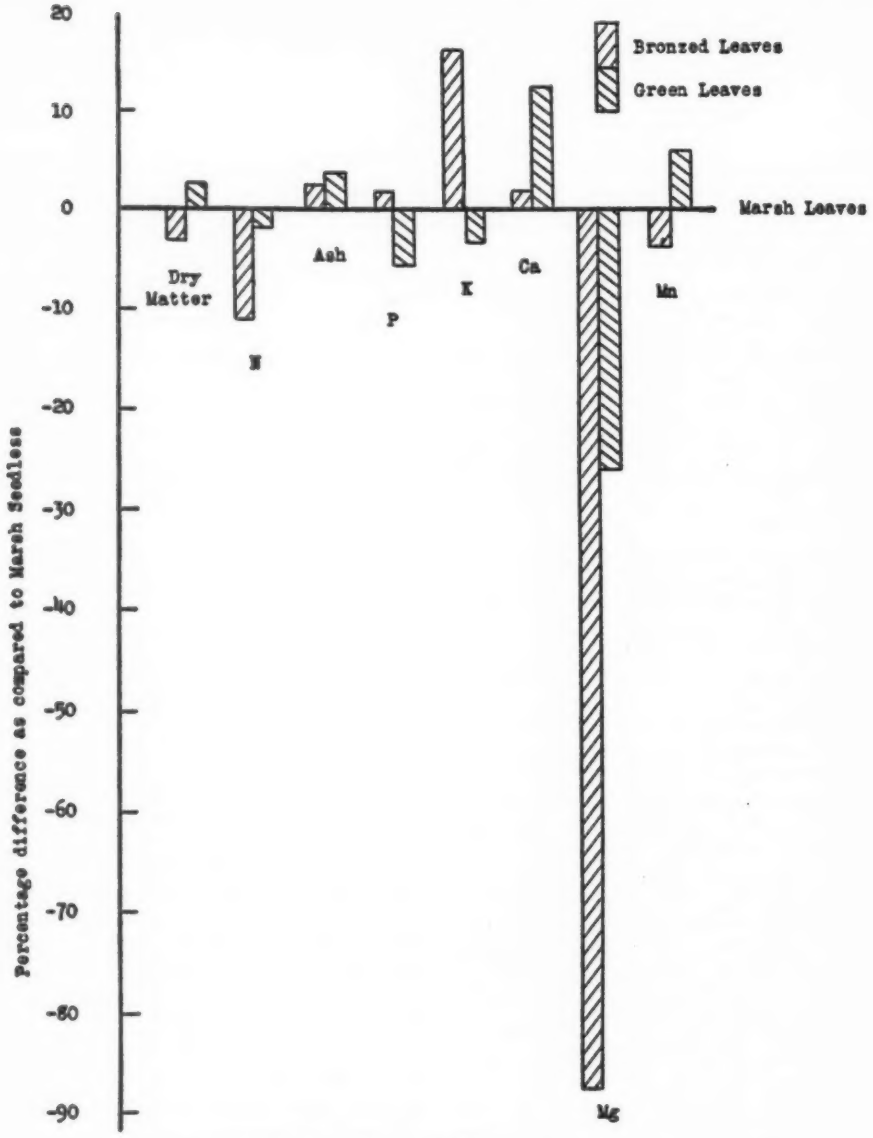

FIGURE 1. Graph showing percentage differences in the average composition of bronzed and green leaves of seedy varieties as compared to those of Marsh Seedless.

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CITRUS CONDITIONS AND GROVE PRACTICES ON THE LOWER WEST COAST

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Fort Myers, Florida

In this discussion, citrus conditions and grove practices will be confined largely to Lee County, as the writer is more familiar with conditions in this section than in other areas of the lower West Coast. The citrus growers as a whole are feeling the effects of the low prices of fruit this year and in many instances production costs will have to be lowered in producing the crop for the 1938-39 season.

The oldest groves in the county are around sixty years of age and are planted on heavy hammock land bordering the Caloosahatchee River north and east of Fort Myers. The Orange River, a tributary of the Caloosahatchee, is also bounded by groves of high production growing on the better grades of hammock land. Many of these hammocks have out-croppings of marl rock and this soil type adds extra quality to fruit grown on such land. Other soil types in this area consist of the better grades of flat-woods land, but are not as desirable as the true hammock type.

Artesian wells are common on the lower West Coast and are found throughout the citrus area. Growers find that irrigating is a comparatively simple problem on the lower West Coast where such wells are used. A valve is opened and the water allowed to flow in open ditches through the grove. In some instances water is conducted in canvas hose from the flowing well to various sections of the grove and growers have found this method of conveying water very satisfactory.

The cold hazards in the vicinity of Fort Myers are not as severe as in other sections of the State. In December of 1934 the official low temperature at Fort Myers was 29 degrees. Groves were damaged to some extent, but most of them recovered quickly within the next twelve months period. During the season of 1935-36 the official low recorded at Fort Myers was 34 degrees. Last winter on November 22nd the weather station reported a temperature of 36.9 degrees, and on December 7th a temperature of 36 degrees was recorded. With the comparatively warm winters that are evident on the lower West Coast, growers are able to force an early bloom and flush of growth ahead of other citrus producing areas. This is one objective that is extremely important in the production of early fall fruit. Growers have found that the early fall market is usually high and aim to produce fruit for movement through September and early October. This is true, particularly of grapefruit. Grapefruit trees receive a heavy application of inorganic nitrogen about January 1st and within a short period, under favorable weather conditions, the buds begin to swell and a new flush of growth and bloom follows.

In the vicinity of Fort Myers frost damage is seldom severe enough to cause damage to this growth. By September first the bulk of the early bloom grapefruit is sufficiently mature for shipment and prices over the last few years have averaged from $1.00 to $1.50 per box on the tree. Lee County has a reputation of being one of the earliest grapefruit producing counties in the State and growers continue to strive hard for early grapefruit production each season.

There is probably more acreage of seeded grapefruit on the lower West Coast than there is of seedless. As a general rule after the early crop

has gone to market the canners then purchase much of the balance. With the low prices of grapefruit the past few years, most of the seeded varieties have been taken by the canneries. They seem to prefer grapefruit from the lower West Coast and have paid a premium in many instances for grapefruit grown in this area.

As for oranges, the mid-season oranges begin movement by the tenth of October. Growers also strive hard to get an early bloom and growth on their orange trees for early fruit, and generally have such growth hardened before aphid injury is severe. For the past few years, however, aphid injury has been severe in oranges on later growth. One packing house in the county last season had moved the bulk of their mid-season oranges by the middle of November. The production of early fruit is the outstanding objective of growers in this section of the State.

Storm and wind hazards are probably greater on the lower West Coast than in many other sections. The storms over the past ten years that have hit Florida have done considerable damage to groves on the lower West Coast. Growers are planning more windbreaks around the groves to combat this hazard.

The lowering of production costs is receiving careful attention, particularly this year with a large crop of fruit in prospect over the State. Growers are paying more attention to the conservation of their cover crops and are growing these in abundance. Dolomitic limestone has been used with success in many of the groves in this area and the growth of natural cover crops has increased tremendously. Very little crotalaria, beggar weed or other legumes are found in the groves due to the uncertainty of the stands and growers are relying largely upon natural grass, Spanish needles and such other vegetation. It is possible to grow heavy stands of natural grasses in this area and every bit of this material is incorporated into the soil in the fall of the year. By incorporating heavy tonnages of green material and humus into the soil, growers are able to use the cheaper inorganic fertilizers throughout the spring and summer months.

Many growers are still using from two to three applications of a balanced fertilizer per year, but many of the growers are now devising ways and means of cutting their fertilizer costs. Considerable interest has also been manifested in the past year in using so-called minor elements, particularly manganese and magnesium. Demonstrations under way have proven the merit of these materials.

On early grapefruit where scab and melanose are expected to be severe, a dormant spray of Bordeaux is applied. This is followed in some instances with a second application two to three weeks after the bloom is shed. The general practice, however, is to omit the Bordeaux applications, as considerable difficulty has been encountered in groves where the copper sprays have been applied.

Growers as a whole on the lower West Coast are following the Spray and Dust Schedule under the "Better Fruit Program" published by the Florida Citrus Commission. Practically all growers are using the lime sulphur program, plus wettable sulphur, for rust mite control, applying the first application about the middle of April. Florida red scale is generally prevalent each year and is one of the most important insect pests on citrus trees. In controlling this pest, growers generally apply liquid lime sulphur, plus wettable sulphur, in May and June when the red scale is in the crawler stage. Excellent results have been secured in some years with an application of this kind, as it kills great numbers of the young scale. In severe cases of Florida red scale infestation it is necessary to apply an oil spray in the fall of the year as a clean-up. This spray is applied after the early fruit has been marketed. Purple scale is present to some extent, but can be more easiy controlled than the Florida red. Summer spraying with oil is avoided as far as possible, as experience shows that if this application is not properly applied and the higher grades of oil used, a considerable burning of foliage and fruit results. Demonstrations are under way this year using zinc sulphate for the control of frenching and many of the larger growers are using this material in larger quantities for the first time this year in their spray program.

Adjoining the coast of Lee County are many islands, the largest of which is Pine Island, and due to the freedom from frost and cold damage on these islands, considerable interest has been

manifested among growers in that area in the last few years in lime production. It is reported that one grower is now planning to complete a planting of one hundred acres of the Tahiti lime. These islands are ideally located for lime production, as the cold winds coming from the north and northwest are tempered by the vast expanse of the Gulf and Charlotte Harbor. New plantings of limes are being made on Pine Island, one of the largest islands off the coast, being approximately twenty miles in length. Some excellent fruit of high quality is being produced in these lime groves at the present time, but most of the groves are still quite young.

In this section growers are experiencing trouble with the various bark diseases and gumming. While growers have not been able to successfully combat these diseases on limes, they do believe that it can be controlled to some extent by frequent fertilizing in small amounts and by cutting the cultivation to a minimum. It appears that the bark disease and gumming is more severe on trees that have received high amounts of nitrogenous fertilizers which in turn produce rapid growth. Growers are now applying their fertilizer in smaller amounts and putting it on more frequently. It appears that the trees should be kept slightly hungry in order to keep the bark disease under control. Cover crops are allowed to grow in abundance and a mowing machine used in preference to harrows. Growers are continuing this practice with the hope of being able to partially control the disease on limes in this manner. However, there are still many things yet to be learned in the control of this trouble.

There is also some acreage of Key limes on the islands that is progressing nicely. This variety has been quite subject to wither tip and anthracnose, and growers have found that Bordeaux spraying is necessary for the partial control of this trouble. The Key lime offers possibilities on the islands and is well suited for growing in this section. Some of the finest quality oranges and grapefruit are also produced on Pine Island and buyers generally pay a premium for fruit grown in this area.

The islands are more subject to damage from high winds and storms than on the coastal regions and trees on the islands have been severely whipped in past years. Growers in this area are taking more interest in windbreaks each year.

Summing up, growers in this section feel that with a favored geographical location that they are in a position to "carry on" under the present outlook conditions and will continue to produce early fruit for the market and in turn strive to lower production costs in future years.

QUICK SOIL TESTS

R. V. ALLISON*

One of the most difficult and persistent questions with which Experiment Station Workers have been concerned ever since the beginning of agricultural research has been the analysis of soils. Through the years it has always been about the same question, "Will you please analyze my soil and tell me what it needs to make plants grow?" With the progress of understanding of soil and plant relationships it soon became apparent that there was not much that could be done with the small, indiscriminately taken soil samples that sometimes arrive in such numbers as to almost plague our dreams. That this is so must be readily apparent from the fact that we have been hard put at times to find any definite correlation between type or treatment of soil and plant growth by means of soil analysis even where the soil treatments were made and the samples taken with the utmost care. Much depends, of course, on the method of analysis used.

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PLANT INFORMATION VITAL

For purposes of our discussion, laboratory work with soils might be divided into two groups, the one having to do with a thorough-going study of

soils or soil profiles as natural objects or formations and the other more largely with the relationship of the soil to the development of plants. While there are a great many studies of the former type going on all the time for purposes of classification, etc., by far the greater amount of effort falls into the latter category.

With the development of Soil Science it soon became evident that the interpretation of soil analyses in terms of plant requirements were not only difficult and futile but definitely dangerous where the soil and plant were not simultaneously studied. Accordingly, at the present time, we still know of but one way that is certain in ascertaining the needs of the plant in a particular soil and climatic environment and that is to "ask the plant." Inasmuch as interest in the so-called "Quick Tests" for soils is impelled not only by a desire to obtain information on soils in terms of plant response, but to obtain it in a hurry, such tests most certainly must call for a careful study of plant relationships and development at the same time.

WHAT ARE "QUICK SOIL TESTS"?

Some time ago, while soil conservation work was passing through the early stages of a robust childhood there developed a strong impulse to cut research corners and get vitally needed information in short order. This type of approach was temporarily referred to as "Rapid Fire Tests," a name which gained for it, at the time, the designation "Winchester Research." In other words, "Six shots (results) in four seconds" should be fast enough for anyone. Now a high-powered shotgun, with such a prolific "rendement," will be admitted by most of us to be an excellent piece of equipment for a number of purposes. If it is manipulated in a too promiscuous manner, however, it might develop results that are eminently unsatisfactory if not highly disastrous.

Unfortunately neither time nor the development of this phase of our work at the Experiment Station to date will permit a detailed discussion of the adaptability of "Quick Test" methods to the examination of Florida soil requirements or deficiencies. In the present discussion the term "Quick Soil Tests" will be understood to mean those carried out with special kits developed for use under field conditions. This method of study has expanded rapidly during the past few years in many parts of the country. For those who are interested, an excellent review and report is to be found in Miscellaneous Publications No. 159 by M. S. Anderson and W. M. Noble of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, under the title, "Comparison of various chemical quick tests on different soils."

Most of the methods that have been developed in this field have come to be known by the name of the man or men who did the work. Among the more important of these are: Hester, Morgan, Spurway, Bray, Thornton, Emerson and Truog. It is upon the basis of the work of these men, for the most part, that such kits as the LaMotte, Hellige and others have been prepared and put on the market. Purdue University is putting out its own testing outfit under the name of "Indiana" that is based on the work of Thornton and his co-workers.

Hester, Morgan and Spurway use acetic acid as an extracting agent. Hester combines it with sodium hydroxide, and Morgan with sodium acetate to give a reaction of pH 4.8. Spurway dilutes the acid 1:3 with water to give a solution with a reaction of pH 2.0. Truog uses a 0.002 N. solution of sulfuric acid which has a pH of 3.00. The Thornton, Emerson and Bray methods involve a solution of ammonium molybdate in hydrochloric acid in such proportions and dilution as to give a pH of 0.1. Bray also uses a solution of sodium perchlorate and perchloric acid that has a pH of 1.1. The above values are according to determinations made on these various solutions by Dr. C. E. Bell in the laboratories of the Department of Chemistry and Soils of the Experiment Station in Gainesville.

As might be expected, a series of solutions with such a range of acidity, varying from pH 0.1 to pH 4.8, when used in different solution to soil ratios in extracting a particular soil will give a wide variety of results. Thus, in studying the phosphorus content of a considerable number of soils with the use of these methods, Dr. Bell found the amount of the element brought into solution by the different reagents to vary greatly.

In a deep phase of Norfolk sand it was found to vary from 0.5 ppm for the Spurway solution to 15.0 ppm. for the Truog. On another Norfolk sand it varied from 4.3 ppm. for the Morgan method to 90.0 ppm. for the Truog. In a general way the Hester solution gave the highest results among the organic group of solvents while the Truog solution gave the highest results among the inorganic group. Mention of this exceptional variation of results with the use of these different solutions is not intended as a criticism of them either individually or collectively.

PRELIMINARY RESULTS WITH A LA MOTTE TEST KIT

In so far as this report is concerned, trials with prepared test kits have been limited to the LaMotte outfit, although others are now on hand or under order for study in the same way. The use of the LaMotte outfit first has been due entirely to accessibility and in no sense by design.

The main series of twenty-five soil samples to be reported on at this time were furnished by Dr. Michael Peech, Soils Chemist at the Citrus Experiment Station. These were selected from a larger series of citrus grove samples upon which he has done a considerable amount of very careful analytical work in the laboratory.[1] Dr. Peech has made his results on these samples available for comparison with those of the "Quick Tests." In these preliminary studies the reproducibility of the values developed by the "Quick Test" has been particularly emphasized.

The application of the LaMotte tests to the samples listed in the tables below has been made by Mr. L. H. Rogers and Mr. R. A. Carrigan, as indicated in the table under analysts A and B. Inasmuch as these readings were not made in the field and were carried out by workers trained in the use of the colorimetric technique, doubtless the variability is considerably less than might be experienced by the average user. Nevertheless, it is believed that the results will well illustrate the principles which it is desired to bring out at this time.

Tables indicating the amount of the four elements, calcium, magnesium, potassium and phosphorus, in these soils, as estimated by the LaMotte test kit follow. The duplicate observations of Analysts A and B are shown and averages for the four are indicated where this could be done with a reasonable degree of meaning. These "averages" are brought together in a summary table, No. 5, particularly for comparison with the laboratory results obtained by Dr. Peech.

(Table I.—The reproducibility of "Quick Test" values for calcium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.) See page 51.

CALCIUM

While poor agreement is found among the duplicate results for calcium in three of the samples, fifteen of them show three values agreeing and seven show complete agreement among four tests.

In comparing the average of these "Quick Test" values, sample by sample, with those furnished by Dr. Peech as determined by routine laboratory methods (see Table No. 5), it is found that there are a few that are in good agreement but a number that are not. Sample No. 157, a high lime Parkwood, is, of course, an exception. In this the LaMotte test showed nearly wenty times as much calcium as the laboratory procedure due, apparently, to the difference in the acidity of the reagents used. However, the laboratory method showed twice as much calcium present as was indicated by the LaMotte test for a Norfolk fine sand, Sample No. 178. The range of variations for all other samples falls between these two extremes.

(Table II.—The reproducibility of Quick Test" values for magnesium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.) See page 52.

MAGNESIUM

Examination of the values for magnesium indicates at once that this element is exceedingly low in most of these soils. It is rated as "Low" or "Very Low" in all except the high lime Parkwood, No. 157, which show an average of "M+."

[1]For a detailed report on the results of this work consult Dr. Peech's paper, "Chemical Composition of Florida Citrus Soils," on page 56 of the Proceedings of the Florida State Horticultural Society for 1938.

Comparing the averages obtained by the LaMotte test kit with the laboratory values listed in Table No. 5, it appears that his element behaves rather more irregularly than calcium. Thus, the average "V. L." shows laboratory values ranging from 1 to 227 pounds of magnesium per acre, while "V. L.-plus," which should be higher, shows a range of laboratory values of only 2 to 125 pounds per acre. Likewise "V. L.++," a single value, is found to represent the highest laboratory value of all—795 pounds of megnesium per acre; while "M+," the highest LaMotte value finds a laboratory equivalent of only 284 pounds per acre.

(Table III—The reproducibility of "Quick Test" values for potassium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.) See page 53.

POTASSIUM

The results for potassium seem to show the best uniformity of the four elements examined. There is also a striking consistency between the averages for the "Quick Tests" and the laboratory values listed in Table V. Thus, for the eight samples showing an average of "<100" in the LaMotte reading, the average of the laboratory values for the same samples is 26 pounds of potassium per acre. The seven samples with LaMotte averages falling between 100 and 200 pounds of potassium per acre show an average laboratory value of 86 pounds per acre, while the six samples with LaMotte averages falling between 200 and 300 pounds per acre show an average laboratory value of 193 pounds per acre. Likewise sample No. 269, showing the highest LaMotte value, 410 pounds of potassium per acre, also shows the highest laboratory value for the element, 855 pounds per acre, though it is more than double the value shown by the test kit.

(Table IV—The reproducibility of "Quick Test" values for phosphorus in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.) See page 54.

PHOSPHORUS

The results of the LaMotte tests for phosphorus appear to be the most erratic, from the standpoint of reproducibility, of all the elements studied.

In comparing the averages for the LaMotte tests with those obtained by a standard laboratory procedure, however, fairly good agreement is to be found in the results of a number of samples (see Table V). This is true, however, only in the lower concentrations. In the presence of larger quantities of phosphorus in the soil as found in the Bladen samples, Nos. 268 and 269, the Blanton topsoil, No. 168, or the Eustis topsoil, No. 174, the difference between the results obtained with the test kits and the quantitative laboratory method is very striking and amounts to several hundred per cent. What either value means in terms of plant response is yet to be determined.

Comparison also is possible in Table V of the LaMotte and acid extraction values for phosphorus with the amount of the element soluble in water. In comparing the water and acid soluble values, the ratio is found to vary from infinity, in the instance of Samples 157 and 227 where no water soluble phosphorus could be detected, to about 1:2 in Sample 226.

(Table V—Summary table comparing the average results with the LaMotte test kit for calcium, magnesium, potassium, and phosphorus, as listed in Tables I to IV, and reaction, expressed as pH, with careful determinations made in the laboratory.) See page 55.

REACTION (pH)

The reaction of the soil expressed as "pH," has come to be one of the most popular of the so-called "Quick Test" methods. In checking the electrometric values obtained by Doctor Peech on the twenty-five soil samples with the colorimetric method of the LaMotte test kit, it was found necessary to use all four indicators, brom cresol green, chlor phenol red, brom thymol blue and phenol red in the latter procedure. These comparative values are to be found in the last two columns of Table V.

An examination of the results indicates that while there is good agreement in the two methods for some samples, others check rather poorly. Thus, of the twenty-five determinations by the two methods, six might be regarded as complete checks, nine more checked within 0.25 pH, and the remaining ten checked within 0.50 pH. Here again the readings were not actually made in the field but in the laboratory. It is unlikely that repetition of the tests on the same series of soils under field conditions would give even as closely agreeing results as those shown in the table. This point most decidedly should be studied further.

The colorimetric tests were repeated a sufficient number of times to note that rather sharp variations may occur on the same sample without any apparent reason. Such variations argue against the value of single observations and bespeak the importance of using good water, keeping the plates clean and using care in manipulating the indicator solution, especially in avoiding the use of an excess.

TESTS OF SELECTED SOILS OF KNOWN FERTILITY OR PRODUCTIVITY LEVELS

In order to determine whether there is significant correlation between the results of rapid soil tests and the known fertility levels of various soils in the field, as expressed in the growth and yield of crops, several samples were collected recently by Mr. J. R. Henderson in north Florida for preliminary study from this standpoint. This represents, in effect, an effort to make the sample the known and the test the unknown.

In taking these samples effort was made to locate two or three different fertility or productivity levels such as "Good," "Medium," and "Poor" for each soil type sampled. Since these samples were taken under general farm conditions and at a time when there were no crops growing in the fields by which to judge the production characteristics of the soil, it was necessary to sample largely by opinion and recollection of the owner or operator.

This first group of topsoil and subsoil samples include:

1. Norfolk fine sand—a dark phase ("Good," "Medium," and "Poor") from Henderson farm near Live Oak.
2. Norfolk fine sandy loam, Partin area near Graceville ("Good," "Medium," and "Poor").
3. Norfolk fine sandy loam—Collins area near Graceville ("Good," and "Poor").
4. Red Bay fine sandy loam, Bishop farm near Monticello ("Good," and "Poor").

The results of the "Quick Tests" of the soils from the Henderson tract are given in Table VI below. All three of these soils have been producing mixed crops of corn and peanuts for a number of years without any fertilizer treatment. The area represented as "Poor" is exceedingly low in fertility and must be "rested" every other year in order to produce any crop at all.

From an examination of the results, set forth in Table VI, it would appear that there is a rather definite correlation between them and the fertility of the soil as indicated by graded crop response. Magnesium is "Very low" in all samples. The calcium values show a regular decline in the topsoil of the three fields from the "Good" to the "Poor" area. It is not clear, however, why the subsoil of the "Poor" area should have a higher content of calcium than either of the other two.

(Table VI—"Quick Tests" for lime, magnesium, potassium and phosphorus on the soils (Norfolk fine sand, dark phase) of the Henderson farm with the use of a LaMotte field test kit.)[1] See page 56.

In a similar way the phosphorus content of the subsoil of both the "Medium" and "Poor" areas is higher than that of the "Good" area. The content of this element is the same for the topsoils of the "Good" and "Medium" areas but is somewhat less in that of the "Poor" area.

The content of potassium in the topsoil of the "Good" area, 150 lbs. per acre, is distinctly higher than that of the other two or of the subsoil of all three since the value for all five other samples is indicated as "<100" pounds per acre.

The soils from the Partin, Collins and Bishop farms from the Graceville and Monticello areas also have been tested but the results will not be discussed in detail. While there seem to be composition trends similar to those found in the Hen-

derson samples, they are decidedly less distinct and consistent. These primary values indicate a definite need for further study with samples that have been carefully taken in relation to crop response under field and greenhouse conditions.

REMARKS

While the work with "Quick Soil Tests" has not been carried far enough to permit us to draw definite conclusions regarding the value of such methods under Florida conditions, a few comments on the subject would appear in order.

The practicability and usefulness of the "quick" type of soil test will be determined largely by the experience and understanding of the operator in terms of the soils and plants with which he is working. That is to say, if the analyst is able to interpret the result he gets on the spot plate or in the test tube in terms of values known to him personally for the soil, soil treatment and plant involved, he is in this way calibrating the test in terms of his own understanding. If he has prepared himself to a reasonable degree in this way, the worker is in a position to take a soil sample of known type but unknown fertility and conduct a much more rational test with it. If the analyst does not have this background of practical experience and knowledge of the soil and plant relationships with which he is working for use as a basis of interpreting his tests, then he should set about getting it, for his readings cannot mean more than an unfounded opinion or a guess until he does. Such an opinion or guess could as well be made by him or anyone else without the test, for its use under such conditions is largely pretense.

If the results of such tests are to be taken seriously, then the routine of their handling must be carefully executed. Good judgment must be used at all times in sampling the soil, in preparing the sample and in noting grove or crop conditions at the time. A clear knowledge of soil and crop conditions cannot exempt the operator from care at all times in the conduct of the test. According to our observations, comparatively slight deviations in the procedure may produce notable changes in the result.

On account of the better control that can be exercised in the laboratory it is believed that more emphasis in the future should be placed on the development and use of the laboratory type of "Quick Test." For this purpose it will be necessary to group the soils of the State in a rather broad way and carry out intensive studies in the field and greenhouse in effectively standardizing requisite methods.

Chairman Brooks: Thank you, Mr. Allison. Are there any questions anyone wishes to ask?

A member: I would like to ask a question. Isn't it possible better results would be obtained if the tests were always made indoors with a standard character of light?

Mr. Allison: I should think light would be a very definite factor. On tests made in the field with a change of light it is hardly possible for an untrained operator to get the same results in the open at all times. My experience with the LaMotte set is that the thing to do is take samples in the field and carry them into a room that is used regularly under standard lighting conditions to make the test. Controlled light conditions would be a very definite factor.

Chairman: Any other questions? Thank you. I will ask Mr. Frank Holland at this time to make an announcement.

Mr. Holland: I wish to speak concerning the afternoon program. We will be guests of Dr. Camp at 1:30 P. M. and Dr. Camp is going to escort us over the property and through the buildings and various plots in groups and give each person an opportunity to see everything of interest to them at the Citrus Experiment Station in Lake Alfred. Then, we will arrange to leave there in time to get to Cypress Gardens about 4:00 P. M. and this will give you a chance to walk through the gardens and see how beautiful they are before you view the Third Annual Gardenia Festival, which commences at 4:30. Mr. Dick Pope, the President and Manager, says he deferred the date of the Gardenia Festival until this time out of courtesy to you folks visiting here in Winter Haven. Sheriff W. W. Chase is furnishing a police escort for us. I also want to mention the pilgrimage to the Jordan Rose Gardens at Bartow at 2:45 P. M. A good many of you ladies and gentlemen will wish to partici-

pate in this and so I bring it to your attention at this time. Thank you.

Chairman: These announcements are all on our program but we wish to call them to your attention especially at this time, so they will not be overlooked. Are there other announcements before the next paper? None. I will read the names of those on the *Legislative Committee.* As you know this is going to be one of our most important committees in view of the coming legislative session. Messrs. J. C. Morton, Auburndale; W. J. Crosby, Ocala; W. E. Sexton, Vero Beach; Ivey Futch, Lake Placid; Tom Swann, Winter Haven; C. D. Kime, Orlando; H. G. Putnam, Oak Hill; Col. Alva Lee, Homestead; H. C. Case, Ft. Myers; W. R. Pollard, Bradenton: H. H. Constantine, Clearwater, and A. S. Herlong, Leesburg.

On the Auditing Committee: Earl Wirt, Babson Park; Leo Wilson, Bradenton;

The Resolutions Committee: C. P. Hammerstein, Hollywood; C. D. Kime, Orlando; Geo. Spangler, Winter Haven.

The Nominating Committee: W. J. Ellsworth, Blanton; Earl Wirt, Babson Park; H. J. Edsall, Bradenton.

I will ask all these persons whose names have been read as being on these different committees to contact your chairman and make arrangements to meet at certain places and proceed with your duties. (Applause.)

Next we will have an address on "Chemical Composition of Florida Citrus Soils," by Dr. Michael Peech of Lake Alfred. (See page 56.)

TABLE I

Soil Type	Sample Number[b]	Depth (Inches)	POUNDS PER ACRE[a] (Ca)[c] LaMotte				
			Analyst A		Analyst B		Average
			1	2	1	2	
Norfolk F. S.	128	0-7	200	500	200	500	350
Norfolk F. S.	136	0-6	200	500	200	500	350
Norfolk F. S.	137	6-18	<100	200	100	100	?
Norfolk F. S.	140	0-5	200	200	200	500	275
Norfolk F. S.	141	5-18	200	200	100	100	150
Norfolk F. S.	160	0-6	200	100	200	200	175
Norfolk F. S.	161	6-18	200	200	100	100	150
Norfolk F. S.	178	0-5	500	200	200	200	275
Norfolk Sand	188	0-7	200	500	200	200	275
Norfolk F. S.	209	0-7	1000	2000	1000	1000	1250
Norfolk F. S.	251	0-6	2000	2000	2000	2000	2000
Norfolk F. S.	304	0-6	500	500	500	500	500
Norfolk F. S.	305	6-18	200	d	200	100	167
Bladen F. S. Loam	268	0-10	1000	1000	1000	1000	1000
Bladen F. S. Loam	269	10-24	5000	2500	4000	5000	4100
Blanton F. S.	168	0-7	1000	500	500	500	625
Blanton F. S.	169	7-18	200	500	200	100	250
Eustis F. S.	174	0-7	1000	1000	500	1000	875
Eustis F. S.	175	7-18	500	d	500	500	500
Gainesville F. S.	226	0-6	500	d	1000	500	667
Gainesville F. S.	227	6-18	200	d	100	100	133
Parkwood S. Loam	142	0-8	1000	1000	1000	1000	1000
Parkwood Loam	157	0-8	40000	40000	40000	40000	40000
Portsmouth F. S.	154	0-12	500	500	500	500	500
Portsmouth F. S.	155	12-18	200	200	200	200	200

[a]Assuming that six acre-inches of soil weigh 2 million pounds.
[b]Samples furnished by Dr. Peech, Citrus Experiment Station.
[c]Using solution standards.
[d]No determination.
?. Average not readily computable.
<. Used here to indicate "Less than."

The reproducibility of "Quick Test" values for calcium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.

TABLE II

Soil Type	Sample Number[b]	Depth (Inches)	POUNDS PER ACRE[a] (Mg) LaMotte				
			Analyst A		Analyst B		Average
			1	2	1	2	
Norfolk F. S.	128	0-7	VL	VL	VL	VL	VL
Norfolk F. S.	136	0-6	VL	VL	VL	VL	VL
Norfolk F. S.	137	6-18	VL	VL	VL	VL	VL
Norfolk F. S.	140	0-5	VL	VL	VL	VL	VL
Norfolk F. S.	141	5-18	VL	VL	VL	VL	VL
Norfolk F. S.	160	0-6	VL	VL	VL	VL	VL
Norfolk F. S.	161	6-18	VL	VL	VL	VL	VL
Norfolk F. S.	178	0-5	VL	VL	VL	VL	VL
Norfolk Sand	188	0-7	VL	VL	VL	VL	VL
Norfolk F. S.	200	0-7	VL	VL	VL	VL	VL
Norfolk F. S.	251	0-6	VL	VL	L	VL	VL+
Norfolk F. S.	304	0-6	VL	VL	VL	VL	VL
Norfolk F. S.	305	6-18	VL	VL	L	VL	VL+
Bladen F. S. Loam	268	0-10	VL	VL	VL	VL	VL
Bladen F. S. Loam	269	10-24	VL	VL	L	L	VL++
Blanton F. S.	168	0-7	VL	VL	VL	VL	VL
Blanton F. S.	169	7-18	VL	VL	VL	VL	VL
Eustis F. S.	174	0-7	VL	VL	VL	VL	VL
Eustis F. S.	175	7-18	VL	VL	VL	VL	VL
Gainesville F. S.	226	0-6	VL	VL	L	VL	VL+
Gainesville F. S.	227	6-18	VL	VL	VL	VL	VL
Parkwood S. Loam	142	0-8	VL	VL	VL	VL	VL
Parkwood Loam	157	0-8	M	H	M	M	M+
Portsmouth F. S.	154	0-12	VL	VL	VL	VL	VL
Portsmouth F. S.	155	12-18	VL	VL	VL	VL	VL

[a]Assuming that six acre-inches of soil weigh 2 million pounds.
[b]Samples furnished by Dr. Peech, Citrus Experiment Station.
H. Indicates "High."
M. Indicates "Medium."
L. Indicates "Low."
VL. Indicates "Very low."

The reproducibility of "Quick Test" values for magnesium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations of two analysts.

TABLE III

Soil Type	Sample Number[b]	Depth (Inches)	POUNDS PER ACRE[a] (K) LaMotte				
			Analyst A		Analyst B		Average
			1	2	1	2	
Norfolk F. S.	128	0-7	180	260	260	260	240
Norfolk F. S.	136	0-6	105	175	220	180	170
Norfolk F. S.	137	6-18	<100	<100	<100	<100	<100
Norfolk F. S.	140	0-5	<100	<100	100	<100	<100
Norfolk F. S.	141	5-18	<100	<100	<100	<100	<100
Norfolk F. S.	160	0-6	<100	100	120	100	?
Norfolk F. S.	161	6-18	<100	<100	<100	<100	<100
Norfolk F. S.	178	0-5	140	110	150	140	135
Norfolk Sand	188	0-7	105	115	130	110	115
Norfolk F. S.	200	0-7	200	220	220	220	215
Norfolk F. S.	251	0-6	220	220	180	220	210
Norfolk F. S.	304	0-6	<100	140	<100	<100	?
Norfolk F. S.	305	6-18	<100	<100	<100	<100	<100
Bladen F. S. Loam	268	0-10	350	350	260	300	315
Bladen F. S. Loam	269	10-24	440	400	400	400	410
Blanton F. S.	168	0-7	140	175	120	140	144
Blanton F. S.	169	7-18	<100	<100	<100	<100	<100
Eustis F. S.	174	0-7	100	120	105	110	109
Eustis F. S.	175	7-18	<100	<100	<100	<100	<100
Gainesville F. S.	226	0-6	220	270	300	280	268
Gainesville F. S.	227	6-18	115	125	105	115	115
Parkwood S. Loam	142	0-8	220	210	220	250	225
Parkwood Loam	157	0-8	240	260	240	220	240
Portsmouth F. S.	154	0-12	160	170	140	180	162
Portsmouth F. S.	155	12-18	<100	<100	<100	<100	<100

[a]Assuming that six acre-inches of soil weigh 2 million pounds.
[b]Samples furnished by Dr. Peech, Citrus Experiment Station.
?. Average not readily computable.
<. Used here to indicate "Less than."

The reproducibility of "Quick Test" values for potassium in grove soils with the use of a LaMotte field test kit as indicated by duplicate observations by two analysts.

TABLE IV

Soil Type	Sample Number[b]	Depth (Inches)	POUNDS PER ACRE[a] (P) LaMotte				
			Analyst A		Analyst B		Average
			1	2	1	2	
Norfolk F. S.	128	0-7	200	150	100	150	150
Norfolk F. S.	136	0-6	200	150	150	150	162
Norfolk F. S.	137	6-18	75	50	75	75	69
Norfolk F. S.	140	0-5	150	150	100	150	138
Norfolk F. S.	141	5-18	50	50	75	75	62
Norfolk F. S.	160	0-6	150	200	150	200	175
Norfolk F. S.	161	6-18	100	75	100	100	94
Norfolk F. S.	178	0-5	100	150	150	150	138
Norfolk Sand	188	0-7	25	25	75	75	50
Norfolk F. S.	200	0-7	150	150	200	200	175
Norfolk F. S.	251	0-6	100	150	200	200	162
Norfolk F. S.	304	0-6	150	150	150	200	162
Norfolk F. S.	305	6-18	75	75	100	100	87
Bladen F. S. Loam	268	0-10	150	200	150	200	175
Bladen F. S. Loam	269	10-24	200	200	75	150	156
Blanton F. S.	168	0-7	200	200	200	200	200
Blanton F. S.	169	7-18	100	100	100	100	100
Eustis F. S.	174	0-7	150	150	150	200	162
Eustis F. S.	175	7-18	100	150	150	150	138
Gainesville F. S.	226	0-6	150	100	200	200	162
Gainesville F. S.	227	6-18	150	150	150	150	150
Parkwood S. Loam	142	0-8	150	100	150	150	138
Parkwood Loam	157	0-8	10	10	10	10	10
Portsmouth F. S.	154	0-12	25	10	50	75	40
Portsmouth F. S.	155	12-18	<10	<10	10	10	?

[a]Assuming that six acre-inches of soil weigh 2 million pounds.
[b]Samples furnished by Dr. Peech, Citrus Experiment Station.
?. Average not readily computable.
<. Used here to indicate "Less than."

The reproducibility of "Quick Test" values for phosphorus in grove soils with the use of a Lamotte field test kit as indicated by duplicate observations by two analysts.

TABLE V

Soil Type	Sample Number[b]	Depth (Inches)	POUNDS PER ACRE[a]									REACTION (pH)	
			Calcium		Magnesium		Potassium		Phosphorus				
										Lab. Meth.[b]			
			LaMotte Av.[c]	Lab. Meth.[b]	LaMotte Av.[c]	Lab. Meth.[b]	LaMotte Av.[c]	Lab. Meth.[b]	LaMotte Av.[c]	Acid Sol.	Water Sol.	Colorimetric (LaMotte)	Electrometric[b]
Norfolk F. S.	128	0-7	350	568	VL	87	240	175	150	272	20.5	5.15	5.16
Norfolk F. S.	136	0-6	350	420	VL	32	170	110	162	368	13.4	5.20	5.50
Norfolk F. S.	137	6-18	A	56	VL	1	<100	23	69	48	1.9	5.00	5.30
Norfolk F. S.	140	0-5	275	300	VL	14	<100	41	138	176	9.4	5.40	5.39
Norfolk F. S.	141	5-18	150	32	VL	4	<100	18	62	32	2.2	5.00	5.09
Norfolk F. S.	160	0-6	175	194	VL	5	B	55	175	234	14.2	5.60	5.44
Norfolk F. S.	161	6-18	150	30	VL	5	<100	19	94	55	8.4	5.00	5.01
Norfolk F. S.	178	0-5	275	500	VL	21	135	78	138	390	15.9	5.50	5.14
Norfolk Sand	188	0-7	275	149	VL	16	115	48	50	35	4.5	5.20	5.20
Norfolk F. S.	200	0-7	1250	1240	VL	24	215	150	175	326	10.3	6.20	6.35
Norfolk F. S.	251	0-6	2000	1065	VL+	27	210	130	162	1840	24.4	5.50	5.45
Norfolk F. S.	304	0-6	500	560	VL	72	C	59	162	240	9.6	6.45	6.24
Norfolk F. S.	305	6-18	167	28	VL+	2	<100	20	87	48	7.7	4.80	4.85
Bladen F. S. Loam	268	0-10	1000	1215	VL	73	315	250	175	1240	36.0	5.60	5.45
Bladen F. S. Loam	269	10-24	4100	5700	VL++	795	410	855	156	3160	92.0	6.20	5.90
Blanton F. S.	168	0-7	625	820	VL	43	144	97	200	625	18.0	5.50	5.90
Blanton F. S.	169	7-18	250	144	VL	13	<100	31	100	112	16.5	5.20	5.39
Eustis F. S.	174	0-7	875	948	VL	54	109	56	162	480	11.7	6.70	6.20
Eustis F. S.	175	7-18	500	353	VL	19	<100	38	138	146	11.3	5.20	5.50
Gainesville F. S.	226	0-6	667	1040	VL+	125	268	300	162	231	3.7	5.50	6.00
Gainesville F. S.	227	6-18	133	218	VL	39	115	72	150	59	0.0	5.00	5.49
Parkwood S. Loam	142	0-8	1000	1300	VL	227	225	196	138	129	8.7	5.20	5.46
Parkwood Loam	157	0-8	40000	2070	M+	284	240	210	10	13	0.0	8.00	8.31
Portsmouth F. S.	154	0-12	500	910	VL	133	162	140	40	26	13.1	5.00	5.26
Portsmouth F. S.	155	12-18	200	152	VL	16	<100	19	<10	10	2.7	5.20	5.06

[a]Assuming that six acre-inches of soil weigh 2 million pounds.

[b]Samples as well as data on replaceable elements and reaction by electrometric method furnished by Dr. Peech, Citrus Experiment Station.

[c]Average of four observations by two analysts (See Tables I-IV).

<. Used here to indicate "Less than."

A. Average of < 100, 200, 100, 100 (?).

B. Average of < 100, 100, 120, 100 (?).

C. Average of < 100, 140, < 100, < 100 (?).

Summary table comparing the average results with the LaMotte test kit for calcium, magnesium, potassium and phosphorus, as listed in tables I-IV, and reaction, expressed as pH, with careful determinations made in the laboratory.

TABLE VI

"QUICK TESTS" FOR LIME, MAGNESIUM, POTASSIUM AND PHOSPHORUS ON THE SOILS (NORFOLK FINE SAND, DARK PHASE) OF THE HENDERSON FARM WITH THE USE OF A LA MOTTE FIELD TEST KIT[a]

Fertility level	Sample number	Depth	Calcium[b] (Ca)	Magnesium (Mg)	Potassium[b] (K)	Phosphorus[b] (P)
"Good"	17	0-7	200	VL	150	125
	18	7-10	< 100	VL	< 100	75
"Medium"	19	0-8	150	VL	< 100	125
	20	8-20	< 100	VL	< 100	150
"Poor"	21	0-6	100	VL	< 100	100
	22	6-18	100	VL	< 100	150

[a]Tests performed by Mr. R. A. Carrigan.
[b]Expressed as pounds per acre of the elements, assuming that the top six acre-inches weigh 2 million pounds.
VL indicates "Very low."
<. Used here to indicate "Less than."

CHEMICAL COMPOSITION OF FLORIDA CITRUS SOILS

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During the spring of 1937 a survey was made of one hundred groves located in the various citrus areas of the state, from which over two hundred soil samples were collected, representing all of the major soil types commonly planted to citrus in Florida. The survey was undertaken primarily in an attempt to arrive at the relative fertility of the various soil types on the basis of the exchange capacity, exchangeable bases, readily available phosphorus and nitrogen, and to determine some of the underlying factors which might affect their management with reference to fertilization and other cultural practices. While it has been generally conceded that certain soils planted to citrus are more fertile than others, relatively little systematic information is available in regard to the magnitude of the differences among the various groups of soils and the extent of variation within any one group or series. Such information is necessarily basic to all research on citrus soils and should have an important bearing on our present fertilizer practice and soil management. At the time the samples were collected careful notes were made on the condition of the grove by Mr. Walter Reuther of the Citrus Experiment Station staff. Detailed data were also taken in regard to the past fertilizer practice, liming and other soil amendments in so far as the records were available. Although the results of soil analyses obtained thus far have given us a better understanding of some of our soil problems and will, no doubt, continue to prove their usefulness in the formulation of our future soils research work, it is believed that the information compiled to date is insufficient and would hardly warrant any attempt at far-fetched correlations of the results of soil analyses with the grove condition. A given soil condition may be considered more static than the grove condition inasmuch as soil analyses represent definite values at the time of sampling, while the grove condition is subject to greater fluctuation and is often the

reflection of a previous rather than the current soil condition. This has been accentuated in the present situation by the fact that many of the groves had received applications of dolomite a relatively short time before the soil samples were taken and in most instances the response to the dolomite had not been noted in the trees. In this study, therefore, the tree condition becomes a variable that will have to be studied in greater detail for a longer period of time in order to establish any definite correlations. This paper is primarily an attempt to give growers and others interested in the citrus industry a clearer picture of the soil itself, a viewpoint that has been extensively overlooked in citrus in Florida.

A brief description of the soils presented in the table is given for the benefit of those who are not familiar with soil classification. A more complete description of the various soils in the state may be found in the Soil Survey Reports or in Bulletin No. 42 of the Florida Agricultural Extension Service.

Norfolk soils represent the well drained undulating to rolling pine and black-jack land. They are characterized by about 4 to 6 inches of gray to dark gray loamy sand underlain by a yellow sand which passes into compact sandy clay beds at varying depths below the surface. These soils grade from a coarse sand (Norfolk sand) containing very little organic matter, commonly called "black-jack" land, to a much finer loamy sand (Norfolk fine sand), the surface layer of which is gray to a dark gray having a higher content of organic matter, and frequently referred to as "high pineland." Some of the better Norfolk soils have a hammock or predominantly hardwood growth. The Norfolk soils are by far the most extensive citrus soils in the state having been planted extensively during the heaviest development of citrus and constitute at the present time a least sixty per cent. of the total acreage.

Blanton soils occupy lower areas or depressions when in association with the Norfolk soils or slight knolls within and surrounding the flatwoods. These soils differ from the Norfolk soils in that the subsoil consists of a pale yellow with splotches of gray to a grayish yellow fine sand which at lower depths from 3 to 6 feet is underlain by sandy clay beds.

The surface layer of Eustis soils consists of 5 to 7 inches of a dark to grayish brown fine sand which is underlain by a light reddish-yellow to a yellowish red fine sand. The subsoil rests on sandy clay beds several feet below the surface.

Lakewood soils have a surface layer of gray sand 4 to 6 inches in thickness grading abruptly into a white incoherent fine sand 8 to 20 inches thick. This is underlain by a yellow to orange loose fine sand which at varying depths rests on reddish mottled clay. Although the fertility of these soils is usually very low, they make satisfactory citrus land where the gray surface layer is 6 to 7 inches deep containing an appreciable amount of organic matter and the layer of white incoherent sand is only 4 to 8 inches in thickness. All of the three horizons just described are included in the Lakewood profile shown in the table. It should be noted that the exchange capacity of the white sandy layer, sample No. 239, is lower than that of the surface layer or the underlying yellow subsoil.

Orlando soils belong to a better group of well-drained upland soils called "high hammock" lands. The surface layer, consisting of very dark gray loamy fine sand ranging from 8 to 12 inches in thickness and very high in organic matter, is underlain by a dark gray loose fine sand which gradually becomes lighter in color with depth. This extends to a depth of about 5 feet overlying clay beds.

Although not planted extensively to citrus, Gainesville soils represent some of the most fertile hammock land in the state. The surface layer consists of brownish gray loamy fine sand underlain by a reddish brown sandy subsoil which is often quite loamy due to the presence of clay. These soils are derived from the disintegration of limestone mixed with deposits of sand and are underlain by limestone or coquina rock.

Parkwood soils are "low hammock" lands supporting a growth of cabbage palmetto, live-oak, magnolia and other hardwoods. The typical soil profile consists of a dark gray to almost black loamy fine sand 8 to 15 inches in depth overlying a gray and yellow mottled loamy fine sand which at 2 or 3 feet passes into a whitish marly clay. Since these soils are quite variable two different Parkwood soils are given in the table. Good

groves are invariably found on soils having a soil profile similar to the one represented by soil samples Nos. 142 to 144 inclusive. The surface layer (sample No. 142) consists of 8 inches of dark loamy fine sand, underlain by 10 inches of dingy brown loamy fine sand (sample No. 143) which passes abruptly into a very plastic, slightly mottled yellowish clay (sample No. 144) about six inches thick resting upon marl and calcareous rock. The soil profile represented by samples No. 145, No. 146 and No. 157 is typical of the so-called "marl spots" which were found frequently associated with a certain grove condition to be described later. The soil profile as shown in the table consists of 6 inches of very dark to almost black sandy loam (sample No. 145) underlain immediately by a grayish to creamy white layer of marl (sample No. 146).

Portsmouth soils are perhaps the most extensive poorly drained soils in the state. The surface layer is a dark gray to gray loamy sand, 6 to 8 inches deep and very acid in reaction, underlain by a light gray to almost white sandy subsoil which at varying depths several feet below the surface passes into a heavy blue mottled clay. When properly drained the fertility of these soils, like that of most well drained soils, is very much dependent on the amount of organic matter in the surface layer.

Bladen soils make excellent land for citrus when properly drained. The soil profile as given in the table consists of 10 inches of dark gray loamy fine sand (sample No. 268) underlain by yellowish gray sandy clay (sample No. 269) containing appreciable amounts of clay which gradually becomes heavier and more plastic with depth and rests on bluish clay mottled in places with yellow and brown.

Soil samples were taken at approximately the periphery of the tree or the point of maximum leaf-drip by means of a stainless-steel tube 1½ inches in diameter. At least 12 borings were made, one boring to a tree, separating all well defined horizons to a depth of 18 inches. In most of the light sandy soils in which the profile is quite simple, samples were obtained at two different depths, the gray to black surface layer 5 to 7 inches thick being separated from the yellow, gray or grayish-white subsoil. The subsoil sample was taken to an arbitrary depth of 18 inches. Both the surface soil and the subsoil borings were composited separately in the field and brought to the laboratory in quart Mason jars where they were air-dried, screened through a 2 mm. aluminum sieve and thoroughly mixed. The following analyses were made: Exchange capacity; exchangeable calcium, magnesium, potassium and manganese; organic matter; total nitrogen; nitrate nitrogen; phosphorus and pH.

The data presented in the table are typical of the results obtained for the various soil types, which are arranged in the order of their exchange capacities. The exchange capacity may be defined as the capacity of a soil to absorb and retain a certain group of plant nutrient elements or fertilizer materials, namely, calcium, magnesium, potassium, manganese, zinc, copper and ammonia, which are referred to as "exchangeable bases." The total quantity of the exchangeable bases any soil can hold is a fixed quantity that can be varied only with difficulty, and is determined by the amount of organic matter or clay present in the soil. The organic matter, or more correctly the "humus," constitutes the main source of colloidal material in the light sandy soils. Because of the small amounts of clay present, the inorganic soil colloids contribute very little to the exchange capacity of many Florida citrus soils. This is substantiated by the ratios of the exchange capacity to the per cent. of organic matter which remain quite constant despite the great variation of the exchange capacity and the amount of organic matter in these soils. The discrepancy noted in the last two samples is due to the presence of clay which tends to make the ratios higher. The organic matter content of a soil is thus a rough index of its exchange capacity, which in turn may be said to be a direct measure of the potential fertility of a soil.

The total sum of the exchangeable bases, excluding hydrogen, expressed as per cent. of the exchange capacity is defined as "per cent. base saturation." A soil is 100 per cent. base-saturated when the sum of the exchangeable calcium, magnesium, potassium, sodium and manganese is equal to the exchange capacity. Such a soil should have a pH value of 7.0, or about 8.0 if free carbonates are present as shown by samples No. 145, 146 and

157. At 50 per cent. base saturation half of the exchange capacity of a soil is utilized by bases like calcium, magnesium and potassium, and the other half is saturated with hydrogen which causes soil acidity. With a few exceptions all the surface and the subsoil samples examined in the Norfolk series having pH values below 5.5 showed less than 50 per cent base-saturation, while the samples with pH values above 5.5 showed over 50 per cent. base-saturation. A fair relationship can be seen in the table between the per cent. base-saturation of the various soils and their pH values. Any departure from this relationship is undoubtedly due to the presence of free fertilizer salts which would be determined and calculated as the sum total of the exchangeable bases, hence making the values for per cent. base-saturation somewhat higher than the pH values would indicate. It should be obvious, therefore, that the total amount of exchangeable bases (excluding hydrogen) that can be maintained in a soil is dependent on the exchange capacity and the degree of base-saturation. Although it seems very desirable to maintain a high degree of base-saturation by replacing hydrogen with bases like calcium and magnesium through applications of liming materials, any attempt to raise the degree of base-saturation to exceed a certain pH value might render manganese and zinc unavailable, thus inducing manganese deficiency and frenching. From the foregoing discussion it should be clear that some caution must be exercised in estimating the lime requirement of soils from pH values alone without due consideration to any possible variation in the exchange capacity of the different soils.

The exchange capacity of the surface layers in sandy soils is considerably higher than that of the corresponding subsoils because of the higher organic matter content of the surface layers. This is also reflected in the greater amounts of the exchangeable bases present in the surface layers. The per cent. base-saturation and consequently the pH values, are also higher in the surface samples than in the corresponding subsoils. In taking the soil samples it was interesting to observe that most of the fine fibrous citrus roots were present in the dark or gray surface layer. The depth of distribution of the fibrous roots was largely determined by the thickness of the surface soil horizon. Only a few fibrous roots were usually noticed in the yellow or gray subsoil immediately below the surface layer. The distribution of fibrous roots and the great differences in chemical composition found between the surface and the corresponding subsoil samples would indicate that the important feeding zone in most of the light sandy soils is limited to the surface layer.

Since calcium is the predominating base in the colloidal complex, the amount of exchangeable calcium found in the various soils is quite proportional to the exchange capacity at approximately the same pH values. For the same reason the exchangeable calcium was found to increase with the increasing pH values in soils having the same exchange capacity. The effect of the pH value or the degree of base saturation on the actual amounts of calcium and other exchangeable bases that may be found in a Norfolk soil with an average exchange capacity is clearly 135 with samples Nos 162 and 183.

Although the amounts of exchangeable potassium varied unduly even in soils having the same exchange capacity there was a general increase in the amounts of exchangeable potassium with the increasing exchange capacity of the soils. If we compare the small amounts of potassium found in certain soils with an average annual application of potash commonly used, it would seem that the loss of potassium through leaching in acid soils very low in exchange capacity is much greater than is usually assumed.

In contrast to calcium and potassium, the exchangeable magnesium found in the light sandy soils is not necessarily proportional to the exchange capacity since this element has come into general use rather recently. Many light sandy soils low in exchange capacity that had been maintained very acid for a long period of time and which had never received magnesium from any of the common sources prior to the date of sampling were found to be extremely deficient in magnesium, containing as little as 5 pounds of magnesium per acre. On the other hand, the better grades of sandy soils, especially those that had received considerable bonemeal in the past, showed somewhat higher quantities of magnesium. It should be noted here, that by the time this sur-

vey was undertaken, magnesium had come into such general use that a majority of the groves sampled had received at least one application of dolomite or soluble forms of magnesium and upon analysis showed considerable amounts of exchangeable magnesium. In general, severely bronzed groves that had received dolomite or soluble forms of magnesium in the fall of 1936 or spring of 1937 when the soil samples were taken showed much less bronzing this spring (1938). Samples Nos. 118 and 119 were taken from the plots at the Citrus Experiment Station showing a very marked response to the application of "Emjeo" and dolomite. All of the Norfolk soils with the exception of samples Nos. 198, 199, 160, 161, 206, 207, 118, 119, 251, 252, 200, 201, 284 and 285 had received at least one application of dolomite prior to the collection of soil samples. The calcareous low hammock soils were found to contain much larger quantities of exchangeable magnesium as shown by the three Parkwoods soils. On the other hand, the acid soils such as Portsmouth commonly associated with the Parkwood soils, showed much less and varying amounts of exchangeable magnesium depending on the exchange capacity and the fertilizer practice.

Most of the soils examined were found to contain only small amounts of manganese showing less than 3 pounds of exchangeable manganese per acre for the surface layers regardless of the exchange capacity. From our limited data it is impossible to say whether such small amounts of manganese in the order of 1 to 5 pounds per acre are adequate to meet the requirements of citrus but it should be pointed out that distinct manganese deficiency symptoms were observed in many groves showing this amount of exchangeable manganese in the surface layer. It is interesting to note that the surface soil sample No. 251 was taken from a grove that had received an application of manganese sulfate and represents one of the few groves showing a higher content of exchangeable manganese in the surface layer. Samples 145, 146 and 157 are typical of the so-called "marl spots" usually found in the cabbage-palmetto hammock soils where the marl layer comes close to the surface or has been mixed with the surface layer in mounding the trees. Common types of frenching due to zinc deficiency and pronounced symptoms of manganese deficiency or sometimes locally referred to as "marl frenching," are usually associated with the "marl spots." That manganese is subject to rapid oxidation and precipitation into unavailable forms in these soils is borne out by the fact that the grove from which sample No. 157 was taken had received an application of manganese sulfate at the rate of 300 pounds per acre for three consecutive years prior to sampling. The oxidation of manganese and its subsequent precipitation into highly insoluble forms proceeds rapidly in soils with pH values above 7.0 and is extremely rapid in marl soils which usually have pH values about 8.0. It is obvious, therefore, that nothing can be gained from very heavy applications of manganese salts on marl soils at any one time in the correction of manganese deficiency, but smaller and more frequent applications should prove more economical and equally effective.

The total nitrogen content of the various soils as shown in the table is governed to some extent by the amount of organic matter, the light sandy soils showing much smaller amounts of total nitrogen than the hammock soils. That nitrate nitrogen content in soils is subject to considerable fluctuation depending on moisture conditions, leaching and fertilization is well known. There is a good indication that soils high in total nitrogen content are more likely to maintain a higher and a more uniform concentration of nitrate nitrogen as shown by the surface sample of Parkwood loam (sample No. 145) containing 420 pounds of nitrate nitrogen per acre—six inches of soil. This is the highest amount of nitrate nitrogen found in the samples examined.

GENERAL DISCUSSION

From the table it is evident that citrus is grown in Florida on a great variety of soils. There is considerable variation within any one group or series. As shown for the Norfolk series the fertility of these soils as well as other light sandy soils can be evaluated on the basis of the exchange capacity which in turn is determined largely by the amount of organic matter present in the soil. It should be recognized that proper management and fertilization of the various types of soils must

be intimately associated with the exchange capacity since the amounts of the various exchangeable bases that can be maintained in any soil even through the best fertilizer practice and management is limited by the exchange capacity. This is well illustrated by soil samples Nos. 292, 293, 296 and 297 which represent our poorest grade of Norfolk soils and are typical of what is sometimes locally called "black-jack" land. One of the surface samples, No. 292, already showing 64 per cent. base saturation and a pH value of 6.25 contains smaller amounts of the exchangeable bases than some of the better grades of Norfolk soils with much lower pH values. In many instances abrupt variations in the exchange capacity were found within the same soil series in the same grove. This variation in the soil was often markedly reflected in the tree condition especially where no adjustment had been made in the fertilizer practice. It is a common mistake to overlook any apparent differences in the soil and treat the grove alike despite any apparent changes in the soil or the condition of the trees. The effect of the variation of the exchange capacity upon the content of exchangeable bases is clearly depicted in samples Nos. 198, 199, 200 and 201, taken from two adjacent blocks in the same grove under the same management. The general appearance of the trees in the block from which samples Nos. 198 and 199 were taken was very poor, whereas the trees in the adjacent block (samples Nos. 200 and 201) were in excellent condition and apparently free from any of the common deficiency symptoms. It would be futile and almost prohibitive to attempt to maintain the same amounts of exchangeable bases in both of these soils because simple calculations show that the sum total of exchangeable bases in the better block exceeds the exchange capacity of the poor block by 1.9 milli-equivalents per 100 grams of soil. To insure an adequate supply of potash, for instance, or any of the other bases in a soil with such a low exchange capacity and to minimize losses by leaching, it would seem more practical and economical to make more frequent applications of fertilizers. The hammock soils on the East and West Coasts are even more variable than the well drained upland soils. It is not unusual to find several distinct soil types in the same grove. There is also considerable variation among the hammock soils belonging to the same group or series. One of the most serious problems confronting the growers on low hammock land is due to the variable nature of the Parkwood soils in regard to the depth of the marl layer. Two of the Parkwood soils given in the table were taken from two adjacent blocks in the same grove. One of these soils (samples Nos. 142, 143 and 144) was found in a part of the grove in which the trees appeared to be in excellent condition as compared with the trees in the adjoining block (soil samples Nos. 145 and 146) showing severe frenching and pronounced symptoms of manganese deficiency. Although the poor block has had more manganese sulfate applied to the soil in the past, the surface sample, No. 145, showed less exchangeable manganese upon analysis than the surface sample, No. 142, of the good block. A number of examinations revealed that good groves were invariably found on soils having a profile similar to the one represented by samples Nos. 141, 142 and 143 already described, while the profile represented by samples Nos. 145 and 146 was found commonly associated with "marl frenching" and other symptoms of physiological disorders.

In conclusion, it should be pointed out that although considerable emphasis has been attached in this paper to the importance of the exchange capacity and the exchangeable bases, nitrogen, phosphorus, salt-water damage and drainage are some of the other important factors to be considered in soil fertility. Unfortunately the analyses for zinc and copper have not been made because of the lack of proper analytical methods. Research work now in progress is devoted to the development of suitable methods for the estimation of small amounts of zinc and copper in soils and when satisfactory methods are available the samples collected in this survey will be examined for zinc and copper. A more comprehensive report on the chemical composition of our citrus soils will be published at a later date. Much of the information collected in this preliminary survey indicates the potential value of such work but the data are as yet inadequate for purposes of correlation.

CHEMICAL COMPOSITION OF THE IMPORTANT TYPES OF FLORIDA CITRUS SOILS

Soil Type	Sample No.	Depth (in.)	pH	Exch. Cap.[1]	% Base Saturation	Lbs. per Acre—Six Inches[2]					% Total N	% Organic Matter[3]	Ratio Ex. Cap. / Org. Mat.
						Exchangeable				Nitrate N			
						Ca	Mg	K	Mn				
Norfolk sand	292	0-5	6.25	1.41	64.0	290	37	21	0	2.0	.022	0.93	1.52
	293	5-18	4.96	0.80	13.5	28	5	13	0	0	.008	0.63	1.27
Norfolk sand	296	0-5	5.86	1.45	44.8	193	30	33	1.2	3.0	.025	0.92	1.58
	297	5-18	4.96	0.81	16.7	40	3	17	0.3	0	.011	0.59	1.37
Norfolk sand	300	0-6	4.96	1.54	32.8	150	19	40	1.5	2.5	.028	0.99	1.56
	301	6-18	4.38	0.94	12.2	28	3	25	0	0	.012	0.65	1.45
Norfolk fine sand	198	0-6	6.25	1.54	86.0	484	10	62	0.5	10	.020	0.89	1.73
	199	6-18	5.24	1.02	16.5	48	2	33	0.3	4.5	.008	0.56	1.82
Norfolk fine sand	138	0-6	5.71	1.75	60.0	315	49	53	2.1	3.0	.031	1.31	1.34
	139	6-18	5.01	0.70	19.0	32	8	17	0.6	0	.009	0.57	1.23
Norfolk fine sand	160	0-6	5.44	1.85	31.0	194	5	55	1.0	5.4	.023	1.01	1.83
	161	6-18	5.01	1.11	10.6	30	5	19	0.3	0	.009	0.56	1.98
Norfolk fine sand	206	0-5	5.55	1.87	45.8	316	5	37	0.9	15	.036	1.05	1.78
	207	5-18	5.19	0.92	22.7	70	3	16	0.2	18	.010	0.45	2.04
Norfolk fine sand	118	0-6	4.79	2.02	33.5	230	9	49	2.2	2.9	.024	1.17	1.73
	119	6-18	4.75	0.71	10.5	20	4	8	0.5	0	.008	0.46	1.55
Norfolk fine sand	196	0-6	5.66	2.44	68.5	580	38	53	1.8	11	.043	1.47	1.66
	197	6-18	5.05	1.03	21.3	73	2	25	0.2	1.5	.010	0.50	2.06
Norfolk fine sand	134	0-6	5.94	2.45	68.5	492	71	100	2.3	4.3	.038	2.21	1.11
	135	6-18	4.95	1.24	13.1	38	10	20	0.7	0	.011	0.60	2.07
Norfolk fine sand	182	0-5	4.60	2.49	20.6	174	11	21	2.8	0	.033	1.37	1.82
	183	5-18	4.64	1.29	12.6	48	5	17	1.8	0	.011	0.64	2.02
Norfolk fine sand	136	0-6	5.50	2.51	52.5	420	32	110	4.7	5.0	.039	1.61	1.56
	137	6-18	5.30	1.03	17.2	56	1	23	0.9	1.0	.012	0.61	1.69
Norfolk fine sand	170	0-5	5.84	2.99	70.0	705	67	46	1.8	77	.048	1.50	2.00
	171	5-18	4.44	1.64	12.0	63	6	11	0.4	18	.013	0.66	2.48
Norfolk fine sand	251	0-6	5.45	3.70	80.2	1065	27	130	17.3	24	.062	2.03	1.82
	252	6-18	5.10	1.24	45.8	194	6	43	0.9	7.0	.010	0.62	2.00
Norfolk fine sand	247	0-6	5.51	3.80	80.8	1000	54	270	2.6	31	.073	2.47	1.54
	248	6-18	4.76	1.65	26.1	134	5	60	0	4	.011	0.61	2.70
Norfolk fine sand	200	0-7	6.35	4.97	68.5	1240	24	150	1.2	5.5	.262	2.24	2.21
	201	7-18	5.31	2.64	16.0	133	8	42	1.4	9.0	.016	1.40	1.88
Norfolk very fine sand	284	0-8	5.41	6.25	32.5	655	38	162	9.3	6	.052	2.62	2.39
	285	8-18	5.05	3.04	12.7	122	6	43	1.6	0	.016	1.45	2.10
Blanton fine sand	166	0-6	5.84	3.89	66.0	875	70	66	2.5	33	.049	1.87	2.08
	167	6-18	4.71	1.82	17.2	96	8	31	0.7	10	.010	0.65	2.80

Blanton fine sand	253	0-6	5.54	4.18	75.0	1070	78	112	3.1	39	.057	1.85	2.26
	254	6-18	4.49	1.70	20.0	101	11	34	0.7	14	.013	0.69	2.46
Eustis fine sand	162	0-6	5.64	2.84	51.7	485	34	94	2.5	8.9	.034	1.46	1.95
	163	6-18	5.09	1.56	17.1	81	6	28	1.7	2.2	.012	0.72	2.17
Eustis fine sand	282	0-8	5.69	6.46	51.2	1120	59	208	2.8	4.0	.060	3.18	2.03
	283	8-18	5.00	3.60	19.5	221	7	93	1.9	0	.023	2.12	1.70
Lakewood fine sand	238	0-6	6.00	3.24	77.5	880	54	73	1.2	20	.057	1.67	1.94
	239	6-12	5.54	0.92	33.9	101	5	30	0	3.6	.016	0.47	1.95
	240	12-18	4.54	1.44	17.2	65	6	46	0	0	.013	0.70	2.06
Orlando fine sand	214	0-12	5.30	6.62	15.1	329	10	106	2.5	4.6	.057	4.06	1.63
	215	12-24	5.00	4.52	11.3	165	6	56	1.5	6.1	.039	3.12	1.45
Gainesville fine sand	226	0-6	6.00	8.50	41.2	1040	125	300	2.3	14	.086	5.50	1.55
	227	6-18	5.49	4.82	16.6	218	39	72	0.9	7.0	.033	3.68	1.31
Parkwood sandy loam	142	0-8	5.46	6.95	64.5	1300	227	196	9.3	18	.016	2.79	2.49
	143	8-18	6.50	5.72	79.5	1210	347	93	0.8	5.8	.038	2.20	2.58
	144	18-24	8.16	14.0	100	3950	950	200	0.6	2.1	.076	5.25	2.69
Parkwood loam	145	0-6	7.86	17.9	100	6450	347	313	0.8	420	.517	10.6	1.70
	146	6-18	8.19	6.63	100	2200	215	195	0.3	163	.219	4.95	1.34
P'k'd. clay loam	157	0-8	8.31	6.60	100	2070	284	210	0.4	97	.125	3.05	2.16
Portsmouth fine sand	150	0-11	5.64	3.73	66.5	775	102	80	1.7	7.0	.046	1.87	2.00
	151	11-24	5.30	0.87	55.5	148	21	22	0.7	1.7	.011	0.53	1.65
Portsmouth fine sand	154	0-12	5.26	5.48	55.0	910	133	140	5.1	6.1	.054	2.14	2.56
	155	12-18	5.06	0.86	54.5	152	16	19	0.5	2.0	.011	0.56	1.54
Bladen fine sandy loam	268	0-10	5.45	5.31	69.5	1215	73	250	26.0	6.0	.065	1.68	3.16
	269	10-24	5.86	21.6	86.5	5700	795	855	12.0	0	.040	2.25	9.60

[1]Exchange capacity expressed in milli-equivalents per 100 grams of soil.
[2]Calculations based upon the assumption that six acre-inches of soil weigh 2 million pounds.
[3]Determined as loss on ignition.

Chairman Brooks: Our time is very rapidly passing so unless there are important questions we will not stop for any question. If there are any important questions please ask them briefly.

Mr. W. F. Ward of Brooksville: Tell me how you are going to handle groves where you apply two or three hundred pounds of manganese and find, a few months later, you haven't any?

Dr. Peech: In a case like that, where manganese goes out so fast, it would be more economical to apply manganese sulfate in smaller applications and more frequently than in one heavy single application. Dr. Camp is studying manganese sprays. I am not suggesting this, because the station does not recommend them as yet, but that is another possibility.

Chairman: Now, at this time, I am going to let you into a little secret—our Society is just a little bit hard up now. We need to have the membership of every man who attends these meetings, if he feels he can possibly afford to join. We want you to feel free to come whether you can afford to join or not, but I just wonder about folks who come a considerable distance, yet can't afford $2.00 to make them real, sure enough members. Your membership will admit you free of charge to the Gardenia Festival that Dick Pope is putting on this afternoon so that will make your Society membership only about $1.50—to see Cypress Gardens and this Festival is surely worth 50 cents of anybody's money. So, I hope you will all take out memberships before you leave at the close of this session.

Now, we will have a loud speaker for our other meetings and this will enable everyone to hear the speakers better. Our next address is by Mr. Edward T. Keenan of Frostproof on "Interpretation of Soil Tests."

Mr. Keenan: I am going to read my speech and I wish we had the loud speaker here now—

Member: We do have one—you. (Laughter, applause.)

Mr. Keenan: Thank you.

INTERPRETING SOIL TESTS

EDWARD T. KEENAN
Keenan Soil Laboratory, Frostproof, Fla.

Dr. Glenn Frank, formerly president of the University of Wisconsin, said:

"The future of America is in the hands of two men—the investigator and the interpreter. There is a shortage of readable and responsible interpreters, men who can effectively play mediator between specialist and layman. * * * Science owes its effective ministry as much to the interpretative mind as to the creative mind. * * * Rarely do the genius for exploration and the genius for exposition meet in the same mind. The investigator advances. The interpreter advances progress. * * * A dozen fields of thought are today congested with knowledge that the physical and social sciences have unearthed, and the whole tone and temper of American life can be lifted by putting this knowledge into general circulation. But where are the interpreters with the training and the willingness to think their way through this knowledge and translate it into the language of the street? I raise the recruiting trumpet for the interpreters."

At the opening of the school of medicine of Columbia University last September, Dr. Nolan D. C. Lewis addressed the 200 incoming students as follows:

"Sometimes I think men are needed who can arrange in synthesis the facts already discovered more than we need new facts."

The subject assigned to me is "The Interpretation of Soil Tests."

Before we can interpret a soil test, we must understand the fundamentals of soil chemistry. This branch of chemistry differs from analytical chemistry as one branch of mechanics differs from another. Soil testing differs from soil analysis. Soil analysis is a measurement of the total ingredients of a soil, while soil testing is a study

(for our purpose) of the adaptability of a soil for agriculture. The interpretation of a soil test involves a consideration of soil chemistry, soil physics and soil bacteriology.

As agriculturists have discovered, soil testing has changed the whole conception of plant feeding because it set us right on many misconceptions. As Dr. Connor, of Purdue University, said in his paper before the American Society of Agronomy:

"As a result of our tests, it was concluded that instead of the field plot soil test being a good check on the accuracy of the rapid method of testing, the reverse was true and the rapid test could be used as a check on the condition of the experiment fields."

Before interpreting soil test data, we must realize that our test can be no better than the soil sample. A test of a handful of soil taken at random is almost valueless. A fair sample of a citrus surface soil is a mixture of soil taken from at least 20 spots to the depth of the feeder roots. For citrus, the subsoil conditions may be even more important in fertilizer recommendations than is the surface soil.

Obviously the whole subject of soil test interpretations cannot be covered here, so only some of the high spots will be considered.

Now, let you and me picture a plant living on a certain fertile soil. As that plant grows and develops, it removes certain elements from that soil. When a certain portion of each element is removed, we can understand that it becomes increasingly more difficult for the plant to extract more. The elements are being depleted. At some point along the line, that soil will become only partly fertile, but it may be clean, healthy, etc., only needing renewal of certain ingredients. How to renew the elements is one of our problems.

Suppose we grow two different kinds of plants on the same soil. Suppose each plant has different feeding requirements, as far as amounts and rate of removable plant foods are required for its development. Then each plot of soil though similar to begin with, will reach its nonfertile state at a different time. One plant, like spinach, may require a large amount of nitrogen. Another plant, like beets, may require a larger proportion of phosphate.

Now, it is easy for us to conceive that a plant whose life is only 60 to 90 days must obtain all its nutrients in a relatively short time. Therefore, this plant must have a large proportion of its nutrients in the quickly available or water extractable form.

You know, a citrus tree is drawing its plant food over the greatest portion of the year, so even though requiring a great deal more total nutrients than the small quick growing plant, it can get along very nicely on a more slowly available source.

As an analogy Prof. Truog offers our money situation: "We have certain loose change in our pocket: it is readily available. We can drop into the cigar store and readily buy a cigar. We have a checking account in the bank which is very satisfactory for the purchase of a suit of clothes. It is available, but not so readily available as the loose change in our pocket. Then we have some stock and bonds or other securities that would be slowly available but perfectly satisfactory for the purchase of a house or an automobile."

There are many soil conditions affecting the availability of nutrients and the ability of a plant to absorb the nutrients. In testing a soil sample, one of the first considerations will be to learn the pH, that is, whether it is acid or alkaline and to what extent. One of the reasons for this test is that plants have difficulty in absorbing different nutrients at different pH values. At high pH values, or in the presence of residually alkaline fertilizers in alkaline soils, the plant has difficulty in absorbing sufficient nitrates, and phosphates, while at low pH and in the presence of residually acid fertilizers on acid soils, the plant will have difficulty in absorbing calcium, potassium and magnesium (positive charged ions called cations).

For the above reasons most plants grow best in nearly neutral soils. But even at that plants will absorb very little phosphates at below pH 6 or above pH 7.5. This is not far from neutral. On the other hand, plants will have difficulty in obtaining sufficient manganese when the pH is above 6. Then again, if manganese is present in a soil below 5 pH, it is probably toxic.

When a fertilizer material is applied to a soil, it will release certain amounts of some soil in-

gredients, different in composition from that which was applied. But this release becomes more difficult year after year as the more easily released compounds are affected.

It is very doubtful if any fertilizer material which we add to a fertile soil acts directly as a plant food. Its effect is primarily upon some other soil ingredient. As an example, potash added to a soil containing calcium, as limestone, will release the calcium. The calcium sulfate content of superphosphate will release magnesium from magnesium soil compounds. Hence to interpret a soil test, we must know what results we are after and what will result from the addition of any material.

Soda added to a soil that contained much calcium clay, will release calcium and will form a soda-clay. As you know, this clay is sticky and affects the waterholding characteristics. It will be very favorable in sandy soils with little clay or unfavorable with silt soil of much clay content.

RATIO AND PROPORTION

It has been found in field and pot tests that the amount of nitrogen which caused severe injury to tomatoes where the potash was at a certain level, did not cause injury when the amount of available potash was raised. In this case it could be considered that injury caused by a large application of nitrogen in the presence of a small amount of potash, might be classified as due to an excess of nitrogen instead of a deficiency of potash. In fact, the symptoms are quite simliar, so whether or not a certain amount of nitrogen is correct, depends, in this case on the amount of available potash we have.

The suitable nitrogen-potassium ratio for tomatoes in sand cultures, has been found to be 2 to 1 when the amount of potassium is adequate, but this cannot be construed to mean that if the potassium was excessive and tests showed that the ratio was 1 to 1, that changing the ratio to 2 to 1 by increasing the nitrogen, would be correct.

Hence, we realize the relation of one element to another is vitally important. The relation of aluminum to potassium may be taken for another example. Under certain conditions, for instance, when calcium and magnesium are low, potassium is so very readily absorbed by plants as to become injurious to the plant cell, but this effect may be largely counteracted by aluminum. In which case, neither aluminum nor the potassium could monopolize cell structure, hence the two elements would counteract one another.

Data shows that the amount of potassium absorbed by a quick growing plant is quite consistent up to a concentration in the soil of about 100 parts per million of soluble or replaceable (available) potassium. After this point is reached, the rate of absorption falls quite sharply. This is, of course, contingent upon the supply of available potassium being kept constant by the maintenance of slowly available potassium sufficient to maintain equilibrium (saturation) with the soil solution, and other conditions satisfactory.

The relation between boron and calcium, sodium and magnesium, potassium and manganese, carbon and nitrogen, could also be cited if time would permit.

BASE EXCHANGE

Dr. Peech, soil chemist of our citrus experiment station, presented an excellent paper last year before this Society on this subject of base exchange. Dr. Peech emphasized the importance of Base Exchange to us Florida growers by selecting this subject as his first public paper to present in the state. Inasmuch as he covered the explanation of Base Exchange so thoroughly, I will not go into detail, but refer you to last year's Proceedings of this Society. As you probably know, Base Exchange is a phenomenon wherein the soil will absorb one element from a compound we apply in exchange for some other element that was already in the soil, thus releasing it for plant use. It is this exchange of base elements that largely accounts for their being available as plant foods.

Soils differ in their capacity to exchange bases and all soils have a limited capacity, hence, differ in their capacity to supply plant foods. Experiments have shown that after adding to a soil a solution containing a certain amount of any one of the bases, such as sodium, potassium, magnesium, or calcium, the exchange will eventually cease, and our original solution will leach away unaltered.

We could have further noticed that the less concentrated the applications, the greater the per-

centage of base the soil was able to absorb, but a less total. That is, a small application gave up a higher percentage to the soil than did a heavy application. You can see the importance of this feature in practical fertilizer applications. Your soil test data can show you how much of any fertilizer material it is economically practical to apply at one time.

There will also be considerable differences on the amount of a substance absorbed by a soil from a solution containing different substances in the solution. Thus, certain soils will absorb and hold twice as much ammonia from a solution of ammonium phosphate as from ammonium sulphate, twice as much potassium from potassium phosphate as from potassium chloride.

Thus we learn the old rule, "Different soils exert absorption power toward the same substance to an unusual extent and different order."

When we add different combinations of fertilizer materials to our soils, we alter to a considerable extent the order of which the bases exchanged with one another. In interpreting your soil test data, you consider the predominating base present in your soil before you can decide on the amount of another base to add.

Then there is the matter of carry-over. It makes no difference what compounds we have been using in the past, there is always a carry-over of some compounds which alter the base-exchanging characteristics. Soil tests show just what these carry-overs are and how tightly they are held, and what will unlock them. You should not add calcium lime to soil deficient in magnesium, because you would exaggerate the magnesium deficiency.

As you probably know, calcium is, or should be, the principal base-exchange compound in the soil. In soils containing large amounts of calcium, for example, limestone, and only small amounts of other bases, very little calcium would be available for our plants, because limestone is only slightly soluble unless attracted by an acid or a solution containing another salt. If we add more lime or a soluble calcium compound such as superphosphate, we would still have only very little available calcium, for the reason that calcium is still the principal base. But if we add another salt, for example, muriate of potash, to this soil, the potassium would exchange with the calcium with the consequences of our lime furnishing available calcium.

In this case, the improved results that we would see in the plant would most apt be due to the calcium that was made available, and not to the potassium. In other words, the potassium being only indirectly responsible for the betterment in our tree condition and fruit quality.

From the above, you and I can see something of what we cause to occur in our soils when we add one or more fertilizer materials. Thus a soil containing a high amount of lime will retain and require more potash or other bases than would a soil low in lime.

On the other hand, you can also see how excessive applications of potash, soda or magnesia might deplete the calcium content of some soils. If the soil test showed that the total calcium content of the soil was low, you would add only a small amount of potash, because a slight excess of potash might put your plants at a great disadvantage. Again, a large application of calcium could lock up too much of our potash and magnesia.

With nitrates and phosphates, the situation is different because base-exchange has nothing directly to do with these two compounds, but the addition of either can change the whole soil complex.

Thus, we must all know what is present in the soil before we can successfully add some other element.

Now when you come to interpreting phosphorus tests, you will find it is very important to know what form of phosphorus has been formerly applied to the soil. If not known, then it is quite essential that your phosphorus tests include several forms of phosphate. You know, some rapid test methods, the LaMotte method, for example, will detect phosphorus from raw ground phosphate rock entirely too easily for citrus culture, though very satisfactory for cow peas.

The amount of phosphorus extracted from different soils by the same extracting solution varies considerably. Some extracting solutions for phosphorus are quite reliable on acid clay and loam soils, but tend to show too high an availability on neutral or alkaline soils or on light-

colored sand soils and subsoils, and too low on organic soils. Hence, you select the proper extracting solution for each soil.

When phosphorus, in any form, is added to a soil there are new and other forms of phosphorus formed; for example, there will be mono, di, and tri, calcium phosphate, along with iron and aluminum phosphate, and phosphatic colloidal compounds, all having different degrees of availability. The presence of these influence the ionization and solubility of still other compounds. This must all be taken into consideration in making any interpretations.

All methods of soil testing must be calibrated against each different soil type. You can illustrate this by repeated leaching of the same soil sample, by the same form of leaching solution, and you will find that the second, third or fourth leaching will often remove even more phosphorus than the first leaching. This is also true of other soil elements. So if you leach 10 grams of soil with 20 cc of leaching solution, you must know how much of the total of each element that the soil contained is removed by your 1 to 2 leaching ratio. For phosphorus, this may be only 10% or it may be 50%, but we must know how much of the total contained in each different type of soil was leached out by a 1 to 2 single extraction.

Phosphate tests are among the most complicated to interpret and most difficult to conduct.

In making fertilizer recommendations from soil test data, one should be influenced by the expected cultivation program, for example, it has been shown that the growing of one cover crop can release for plant use as much phosphorus as contained in 100 lbs. of superphosphate, and as much potassium as contained in 200 lbs. of muriate of potash. Hence, the interpretation of test data for a citrus grove, when clean cultivation is practiced, will not fit when a good cover crop is grown.

Soil test data is especially valuable in anticipating future plant behavior while an analysis of the plant ash may throw light on past soil conditions. hence, soil tests should go hand in hand with plant analysis.

Soil test data must be tied in with plant absorption knowledge before fertilizer recommendations can be made. For example, soda added to a soil containing lime will probably increase the available calcium from that lime. But soda depresses the absorption of magnesium by the plant, so, while a soda application may favorably affect the calcium situation, it may have an adverse effect upon the plant by hindering the plant from absorbing the required magnesium.

This brings us to a consideration of the moisture condition. That the degree of soil moisture has an effect upon the degree of certain deficiencies within the plant, has been definitely established, and the absorption of the elements by the plant is in close relation to the absorption of moisture. No interpretation of soil test data is possible without consideration of this matter.

To illustrate: It has been shown that some of the constituents of plant ash are taken up in increasing quantities as the water requirement of the plant is satisfied. This is particularly striking in the case of calcium. In other words, calcium is most readily absorbed by the plant from moist soil.

The up-take of potassium phosphorus, and magnesia in relation to moisture, follows the same rule, but is not quite so consistent. In some cases, even in the presence of an ample moisture supply, due in part to the calcium, plants grown on moist soil contain relatively less potassium, phosphorus and magnesium than do plants on relatively dry soil. In this case, calcium, in the presence of ample moisture, will depress absorption of other elements. Hence, in interpreting soil tests, the moisture conditions must be anticipated.

While ample moisture conditions favor the elements just mentioned, the degree of Manganese absorption in plants will be less on wet soils than on dry soils. It is sometimes noticed that Manganese deficiency appearing in plants, persists even when it is known that ample Manganese is present in the soil. It is then further noted that these symptoms disappear in the new growth when the soil dries out. The appearance of the plant under these conditions is not exactly unlike that indicating Magnesium deficiency and this emphasizes the uncertainty of a diagnosis based on observation of symptoms.

Chairman Brooks: We are not quite through. Do not go yet, please. I am sure you will want

to hear the letter I am going to read you. This letter was sent to Mr. Bayard F. Floyd, Secretary Florida State Horticultural Society, Winter Haven, Florida. It is from Walter Stirling of Davie, Florida. I will read it:

"Dear Mr. Floyd: On Wednesday, April 13, our father, Frank Stirling, will have a birthday. Several months ago we had planned to hold some sort of celebration on this date, but the Horticultural Society meeting interfered. Would we be asking too much of you to sometime during that day make a small announcement of the fact to the assembled Horticulturists and in doing so send him our greetings? I am sorry that I will be unable to attend the meeting this year. I am only a member of two years standing and it appears as though I will start early in missing some of the meetings. Very sincerely, Walter Stirling."

Members rose to their feet and applauded.

Mr. W. F. Ward of Brooksville next introduced Mr. Henry Jahr from the Robins Estate in Brooksville, who has been doing horticultural work in this state since 1886. Mr. Ward said he went through the freezes of '86, '94, '95 and some freezes since. He has been employed by the state on various work and has done a good job. I believe he was the man responsible for making practically all the plantings on Snell Island and for several years was in charge of the floral gardens at Kenilworth Lodge, Sebring. He is now doing work on that portion of the government experiment station which was retained for the private work of Col. and Mrs. Robins, and is doing a good job. I thought you ladies and gentlemen might be interested in seing a man who has been working along horticultural lines for so many years and has done such a good job. (Applause.)

Chairman: Our next address is by Mr. W. E. Sexton, of Vero Beach.

CITRUS PRODUCTION PRACTICES IN THE INDIAN RIVER SECTION

W. E. SEXTON
Vero Beach

The very nature of our soil and the topography of the country in the Indian River section make citrus practices in this area different from the practices found in almost any citrus growing section in the State. The majority of our orange groves in the Vero Beach area are in a drainage district. Twenty-five years ago very little citrus fruit had ever been grown in drainage districts.

Our water table fluctuates and as a result of this we have to practice shallow cultivation, if any, on account of the fact that the feeding roots of the orange trees are within the first six to eight inches of the top soil.

We are in the artesian well belt where flowing wells can be gotten at from four to six hundred feet in depth.

Groves are grown on hammock, marl prairie, muck and flat woods lands.

In the early growing of citrus fruit in this area it was thought necessary to flat weed these orange groves and most of the growers followed this practice until eight or ten years ago. At the present time it is the exceptional case where a grove is cultivated or anything done to it except mowing the weeds some two or three times a year.

The general practice in preparing land for an orange grove is to plow up a bed from twenty-five to thirty-five feet in width and on this bed build small mounds for the trees. The water furrows formed by this method of plowing furnishes drainage during the rainy season and allows us to use the open furrow system for irrigation during the dry season. As most drainage districts are designed to carry off the average rainfall and not the flood rains we have found in actual practice that it is advisable to have a system of dikes and pumps. The groves in the major part of our drainage district are equipped with pumps and control gates which allow the owner to pump the excess water off in flood times.

The pumps generally used are one designed by Couch at Grant, Florida, and one designed and manufactured by Leonard Gollnick at Vero Beach. Over a period of years these pumps have proven to be very efficient, economical and satisfactory.

I thought it would be interesting to take a specific grove and give everything incident to the production of a citrus crop on that grove for a period of one year, together with the cost, time of application of fertilizers and sprays and also the age of the grove, yield per acre, the cost per box, the selling price and the net return. This grove is in a drainage district.

I have a care-taking organization set up to care for grove properties. We say that we are prepared to select the land for you, clear it, set it to trees, care for the grove, pick the fruit, pack it and ship it for your account.

We have about eight hundred acres of grove properties under our care and management and the property on which I am going to give you the cultural practices is one of these properties where our operating company does all the work.

This particular tract of land is a forty-two acre grove which was set in February, 1927, and the year I have selected is the year covering the fruit crop of 1934-35. The type of soil is dark sandy loam underlaid with shell and marl. In some instances there are only three or four inches of top soil on the marl and it has a pH reading of eight and above. In the sandy loam and muck areas of the grove the pH reading at the beginning of the planting was as low as four. The trees are set on mounds and the beds are thirty-five feet wide. The trees are set twenty feet apart in the row. In this grove there are 1,420 grapefruit trees and 1,125 orange trees.

We use chemicals and not mixed fertilizers and apply them separately.

During the month of January we applied 2,400 pounds of Nitrate of Potash on this grove at a cost of $95.23. On the marl lands we applied 3,300 pounds of Manganese sulphate which cost $118.80.

In February we applied 2,200 pounds of Calurea at a cost of $93.50 This material was used on the marl soil having the high pH reading of eight and above. We applied 6,700 pounds of Calcium Nitrate at a cost of $128.96.

In April we were able to purchase ashes produced from the burning of cotton hulls which ran high in potash—14,760 pounds at a cost of $135.40. During this month we also applied Sulphate of Potash—8,000 pounds at a cost of $240.00.

In July we applied 1,600 pounds of Muriate of Potash at a cost of $36.80.

In August we applied 100 pounds of Manganese Sulphate at a cost of $3.20.

In September we applied 4,600 pounds of Muriate of Potash at $92.00.

In December we applied 2,800 pounds of Lime which cost 25.90.

We generally spray four times a year. We gave the grove a dormant spray in January with a copper spray to control lemon scab which occurs more frequently in our area than in some other areas in the State.

In April the grove was sprayed with copper solution to control scab and Melanose. In May we sprayed with Lime Sulphur to control the rust mite and in June we sprayed with an oil spray to control scale. During the last days of September the grove was sprayed with Lime Sulphur to further protect the fruit against rust mite.

The total cost of spraying and applying fertilizer and other labor costs on this grove was $1,850.99. The total cost of materials was $1,597.39, or a grand total of $3,448.38.

The grove produced 13,264 boxes of fruit at a cost of .2599 cents per box. There was a total net profit of $12,303.05.

During January we applied Manganese on the ground at the rate of five to six pounds per tree on the trees growing on marl. Since that time we have been spraying our trees with a five per cent. solution of Manganese and five per cent. zinc and have been getting as good results as when the material was applied to the ground.

We are now following the practice of adding from eight hundred to one thousand pounds of Dolomite per acre annually to our acid lands.

You will note that no phosphate was applied during the year of the 1934-35 crop. A ton and a half per acre of Colloidal Phosphate had been added to this grove in previous years and it was not thought necessary to add phosphate.

Earlier in this paper I said we had a fluctuating water table. It might be interesting to the growers in the higher lands of the State to know that we had a flood condition in the area where this grove is located this past season and this particular grove stood waist deep in the water furrows for more than a week. It did not drop its fruit and is in as fine condition today as you would expect any grove to be in at this time of year.

It has been written that the orange tree can stand more rough usage than any other tree. If you could have seen this grove during the flood time you would believe that this is a true statement.

PROCEEDINGS

OF THE

Krome Memorial Institute

SIXTH ANNUAL MEETING

WINTER HAVEN, FLORIDA, APRIL 13, 1938
8:00 P. M.

Dr. H. S. Wolfe, Homestead, Vice-President, presided as Chairman at the meeting.

Dr. Wolfe: It is already eight o'clock, so I think we might just as well get started, as the evening program is not going to be short. We have installed a loud speaker so all will be sure to hear the addresses this evening.

I have a deep disappointment for you, in that Dr. David Fairchild, our first speaker on tonight's program, is unable to be here. It seems an old friend, Dr. Thomas Barber of Harvard, is on his way from the West Coast to see him for just a couple of days and since he needed Dr. Fairchild's help in locating some specimens he wanted, Dr. Fairchild felt he must answer that call first. He asked me to convey his regards to his many friends present at this meeting and he hopes next year he will be able to greet you personally.

I have his manuscript here, and he has asked me to read it and suggested I could probably cut out a good deal of it and shorten it as it is rather long. I looked it over carefully to see what could be done in that line and I felt it was like trying to decide which part of a statue that was too large for the box in which it should be packed should be cut off. Should I take off an ear, or the nose, or a finger, or what to remove from this work of art, when it seemed impossible to remove any portion without damage? So I came to the conclusion I would read it all and I beg your indulgence if it seems too long. Last year Dr. Fairchild attempted to give his address without written notes, and found himself so full of memories that when he got through he had hardly said one-tenth of what he meant to. So this year we have his prepared manuscript to be made a matter of permanent record. I trust you will find it as full of fascination and interest as I do. (Applause.)

(See pages 11 to 33 for Dr. Fairchild's address.)

BREEDING EXPERIMENTS WITH THE SOUTH FLORIDA NATIVE GRAPES

JOSEPH L. FENNELL
Miami, Fla.

It is well understood, of course, that the science of grape culture is centuries old, but in regard to its special adaptation to South Florida conditions there seemingly has been very little if anything previously done. Our superb wild material has been woefully neglected, even to a large degree unknown, both viticulturally and botanically. In view of this fact, as also of the wide scope of the subject, I make no claims to authority for any of the statements or the theories advanced herein. It is simply my belief and understanding of the matter at this time and is meant to be taken only as tentative.

The general aim of my personal hobby of breeding our native grapes has been to develop a race of high quality vines adapted to the peculiar

growing conditions of South Florida. In this effort two possibilities have been kept in mind. First, for planting as a garden vine for home fruit production at a time when there is a scarcity of fresh fruit (May to September) and, second, for commercial production to reach the markets at a time when the prices are perhaps the highest of the year (May 1 to July 1). At this time no California and very few Central Florida grapes are on the markets, which is, of course, too early for any other sections of the country. Between these dates practically the only supply of this fruit is by importation from Argentina or through the facilities of cold storage. The date at which active growth begins with the early kinds in the Miami area is about February 1. Fruit ripens as early as April 26. These dates are even ahead of those of Central Florida.

Here appears the proper place to mention, in regard to our section, the disease that is perhaps the worst scourge of grape growing in the northern states. This pest known as black-rot is held in check in the greater portion of the country only by systematic spraying, without which in many vineyards the crop would be a total loss. It is my present belief that the Miami area is spared the serious effects of this fungus. To become established black-rot must have a few days of cloudy or rainy weather in the early stages of fruit development. Along the lower East Coast the weather at this time is usually dry and sunny. It is obviously this same condition that makes Southern California free of the disease.

Now that we have outlined the seeming possibilities and needs of suitable grape varieties for South Florida it might be well, while passing, to touch upon the subject of the now existing sorts. Of all the hundreds of American and Vinifera kinds tried in the state in years past it is only the Munson hybrids (Beacon, Carman, etc.) that have given any promise whatever. The chief progenitor of this latter group is *Vitis lincecumii glauca*, a wild grape native from North Texas to Missouri. These varieties are the basis of the vineyard industry in Central Florida. However, even these kinds are by no means satisfactory in the south half of the state. The underlying principles of why none of the present cultivated grapes succed in this section is a long story and will not be discussed at this time. But as a synopsis we might add that of the two classes of bunch grapes grown in the world, the first, the Vinifera series, including Malaga, Thompson Seedless, Tokay, etc., is very sensitive to attacks of mildew and other fungi and so requires a dry atmosphere and near semi-arid conditions during the growing season. The other group, the American Euvitis class, including such kinds as Concord, Delaware, Niagara, Beacon, etc., is definitely a temperate fruit of northern parentage and does not long survive the warm and dry winters of Southern Florida. Thus, we can see that the climate of this section is suited to neither group.

From the foregoing, then, it should be easily understood why we do not at present grow grapes in South Florida and why we shall perhaps never grow them successfully until new kinds suited to the conditions are developed. Adaptability to our peculiar soil and climate appears possible in but one way. That is by the amelioration, breeding and selection of the best strains of our native grapes which through the ages have adapted themselves to the conditions.

By this rather lengthy discussion I have attempted to show the importance of the native and tropical American vines. And it is this belief in their value that has fostered in me an ardent and enthusiastic desire to study and collect the best of our wild species.

The phase of botanical classification of the grapes of this section has been very troublesome. All previous work along this line has been most incomplete, and so the manuals listing the flora of the region have been of very little aid. In fact, many of the species descriptions appearing therein have been erroneous, and of what now appears to be perhaps two of the four most valuable horticultural forms there was no mention whatever. Obviously, there remained but one course to follow. That was to get out into the woods and swamps and study these plants myself. This I have done, and as gradually the rather baffling genus has separated itself into its component species the range of each form has been charted on the map with notes made as to quality and vigor of type, soil conditions, general ecology, etc. In areas where the range of two or more desirable

forms overlapped special efforts have been made to locate any superior strains or natural hybrids. By this method one could almost know in advance the chances that desirable vines might exist within a certain locality, either through the processes of hybridization, variation, or both. Thus, through the exclusion of large supposedly barren areas special attention has been devoted to the points of concentration.

While upon the subject of our native species it might be well to touch upon some of the merits and demerits, horticulturally speaking, of the several principal kinds. First, let us take the series *Labruscoideae,* which is represented here by *Vitis shuttleworthii,* the fox-grape of South Florida. This species is very closely related to the fox-grape of the northeastern state, *Vitis labrusca,* the vine from which the greater portion of the northern cultivated sorts have been derived. Its good traits are: large berry (often three-fourths to seven-eighths inch in diameter); sweet pulp; small seeds; great vigor and resistance to extremes of drought and moisture; resistance to all insect and most fungus diseases; very prolific; adaptability to a wide range of soil types (acid to alkaline). Its bad points are: tough pulp; musky flavor; acid juice; medium to small cluster; and often in hybrid forms a rather weak resistance to downy-mildew.

The other series of viticultural value is that known as the *Aestivales.* This group is represented here by about four or five species, two of which are of viticultural importance. To simplify the matter we shall discuss it as a group rather than as component species. Its chief merits are: great resistance to downy-mildew and other fungi; resistance to drought; large clusters; fine vinous quality of fruit; high sugar content; vigor, etc. Its shortcomings are: medium to small berries (one-half to three-fifths inch in diameter) and often a sensitiveness to alien soil conditions. The previously mentioned Texas species, *Vitis lincecumii,* the progenitor of the kinds cultivated in Central Florida, is a member of this series. Our several other wild species not included in either of these classifications appear to have little pomological value and will not be discussed here.

We have already seen that, exclusive of California, viticulture in America is built mostly upon three northern species included in the two series, *Labruscoideae* and *Aestivales.* From the Florida standpoint the two most important northern species are *Vitis labruca* and *Vitis lincecumii.* Now if we take the best of our local members from each of the two named series and compare them point for point with their northern cousins (size of berry and cluster, quality, productivity, etc.) we shall see that they are not excelled and in some respects scarcely equaled. I have a few wild kinds that in size of berry and cluster, appearance, quality and sweetness, compare favorably with many of the northern cultivated varieties. Of the five best native grapes found in the several seasons of intensive searching one is a pure *Vitis coriacea;* two appear to be natural hybrids of this species with *Vitis simpsoni;* another is possibly a distant marginal form of *V. rufotomentosa,* but with larger fruit. The fifth plant is to all appearances a new species as yet undescribed.

If we take our atlas and systematically check off all tropical and sub-tropical regions of the earth, and then in turn we consult the most up-to-date manuals for the genus *Vitis,* we shall not for all this great expanse find mention of true wild grapes comparable to several of our local kinds.

We now come to the question of the amelioration and improvement of our local material. This it seems is most quickly done by cross-breeding with the finer cultivated sorts. That our native kinds will hybridize with the finer European and American varieties I have already definitely proven and so now have small hybrids of these wild vines, and even of *Vitis tiliaefolia* from Cuba, with the finer vineyard grapes.

In connection with the work of breeding the vines much difficulty has been experienced, principally in the matter of obtaining proper pollen for impregnation. Due to our early growing season it has proven most impractical to obtain fresh pollen from other sections. In view of this situation about ninety-five varieties of the best American and European grapes have been planted out alongside the native kinds. Many of these cultivated sorts have died outright; the majority have shown little inclination to prosper, and a very few have grown fairly well. This rather successful

group has been of little aid in providing pollen since, due to their northern parentage, they seemingly have a chill requirement lower than is generally afforded in this area. As a result the dormant period is often prolonged into the spring mostly too late for possible use. However, by using various methods of grafting; artificial chilling of scions; pollen preservation; pruning, etc., a limited amount of hybridized seed have been obtained. From present indications it appears that possibly six to ten thousand of such fertilized seed might be expected this summer.

In the testing of new hybrid varieties very little has as yet been done. At the present time I have several hundred small seedlings of promise. Several older yet unfruited hybrids have shown remarkable resistance to drought and insect or fungus pests. One vine, a hybrid of *Vitis coriacea* crossed with Delaware, is of fruiting age and has a red berry of medium to large size; is of moderately good quality, and is self-fertile. It seems perfectly at home in our climate and soil. Of course, one would expect a high quality progeny only after a very rigorous culling or selection has been carried out. To do this many thousands of seed must be planted each year and the whole project carried forward on a rather large scale.

In conclusion, I trust that I have given no implication to suggest that, to me, grape culture appears feasible in Southern Florida at the present time. For certainly such is not the case. It is only that I have attempted to describe what seems to me to be an ultimate possibility, provided, of course, that suitable varieties are available. And again, that such varieties should be possible in view of our wild material. A high quality commercial group would not be expected in the F 1 generation, since the earliest kinds of our wild grapes are of low quality. However, I believe that such could be obtained in the second or later generation of crosses. The true answer to this must, of course, await years of further experimentation and study. (Applause.)

Dr. Wolfe: I have a couple of announcements to make at this time. First, at the close of this program tonight it will be your duty to elect a Vice-President for the Institute for next year. I hope the members of the Institute present will be thinking over candidates and lobbying for your choice during the next two or three papers. The next two papers on "Persian Limes" I am sure will be very interesting. We are fortunate in having with us the author of the next paper. I was afraid this afternoon he was not going to be here either, but he showed up tonight. Mr. Ivey Futch:

Note: The subject of the above report has been conducted entirely as a personal enterprise and has no connection whatever with the United States Department of Agriculture, with which the author in another capacity is affiliated.

J. L. F.

PERSIAN LIMES IN THE RIDGE SECTION OF FLORIDA

IVEY E. FUTCH
Lake Placid

I have been asked by your able Society to prepare a paper on "Persian Limes in the Ridge." First let me say, to be accurate on this subject is almost impossible, even though I have been actively interested in Persian Limes for about nine years.

A few months ago I had a letter from a grower in the middle of the Everglades, a settlement scarcely known, advising he had Persian Limes. At that time I knew of no citrus being grown in that vicinity. However, with the present enthusiasm over this wonderful acid fruit, I am sure attempts will be made to grow limes over the entire citrus belt, as well as many sections not classified as being good for citrus culture, due largely to the high prices growers have received, in past years, for this fruit.

Now to survey the Ridge area on Persians as to acreage at present planted and prospective acreage suitable for planting. It is my estimate that almost 800 to 1,000 acres have been planted to Persian Limes. Of this, I would say there are about 450 to 500 acres bearing. Any of the good Norfolk sand soil in the Ridge, seems to be suitable for the growing of Persians and there ap-

pears to be plenty of this type of soil available, although not so much of it is located so as to give needed protection against cold.

Some of the smart citrus growers on the Ridge have top worked other varieties of citrus to limes, giving quick heavy production, thereby taking advantage of good locations already planted to other citrus, which might not be so lucrative as limes.

My information is that in 1934-35 domestic limes amounted to about 10% of the limes consumed in this country; in 1935-36 they amounted to 20%; in 1936-37 to about 27%, and I would guess that the 1937-38 period will run about 37%, and of this domestic production, it appears that Florida produced 80% of same, and it is my opinion that 70% of said domestic production was Persian Limes.

I feel convinced that the Ridge section in Florida produced 50% of the Persian Limes shipped from Florida. Now I am informed that there were about eleven million pounds of limes consumed in this country last season, therefore it seems that the Ridge only produced about 10,000 to 15,000 citrus field crates or 20,000 to 25,000 bushel field crates.

Persian Limes for the past nine years have ranged in price from $1.25 per citrus field crate f. o. b. shipping point or packing house to $18.00 per citrus field crate. In pounds this would be .0113 cents per pound to .163 cents per pound. For the past three years I would say the average net per citrus field crate has been $4.50 or about 4 cents per pound. For the 1936-37 period I think the average was $3.25 per citrus field crate or about 3 cents per pound. It is my prediction, with the increased production, which seems sure to come within the next three or four years, that Persian Lime prices will be somewhat less than realized on the 1936-37 crop; and especially so if no concentrated or collective plan of sale promotion and advertising is given this wonderful acid fruit.

Methods of cultivation and fertilization, by the better lime growers on the Ridge, seem to differ somewhat from those applied to other citrus. There seems, at the present time, a tendency to do less cultivating and more frequent fertilizing, using higher organic fertilizer mixtures, as well as a higher percentage of potash. I do not know that anyone could give a definite reason for these practices, for certainly we lime growers are experimenting in the culture of this fruit.

As for spraying, no doubt in years to come pests which are attracted to other citrus, will attach themselves to this somewhat new host. However, for the present there appears to be very little necessity for spraying Persian Limes, except in cases of Silver or Purple Scale. This is very fortunate, for there are other troubles which cause great concern, namely, our gumming diseases. Some growers have reported as great as 35% to 40% loss from this cause and on investigation, it seems, the average mortality in groves from one to five years is 5% to 10% per year. It is also observed, however, in the few older groves in this section, with which I am well acquainted, that older trees seem less susceptible to these gumming diseases.

Since limes are more or less everbearing, it seems reasonable that they should be fed and watered more often. Therefore, I believe that irrigation is almost essential, if best production is to be had.

I have been asked many times what I considered the cost of growing Persian Limes and I have tried as best I can, after comparing figures with other growers in the Ridge, to do this, and while I am sure that some figures used may be just as wrong as right, they will at least furnish a starting point from which to work. We will take a five-year-old lime grove, since most of us know Persian Limes start producing at age of three years. When a five-year-old grove is well cared for, I believe we can use the following figures as cost estimates for Persian Lime production per acre in the Ridge Section of Florida:

3,000 lbs. fertilizer, at a cost of about $36.00 per ton	$ 54.00
Spraying about	3.00
Irrigation about	22.00
Mortality (due to gumming)	20.00
Cultivation	4.00
Total approximate cost per acre,	$103.00

Figuring a five-year-old grove planted 70 trees to the acre, producing one citrus field crate of limes per tree, would show 70 citrus field crates

of limes, at a cost of about $1.50 per crate, weighing 110 pounds or .0137 cents per pound. As in other citrus, no doubt this cost will come down as growers learn more about the care and cultivation of this fruit. Further it is possible, with increased production, that the cost of packing and handling would decrease. However, it is my opinion that limes, as well as avocados, are yet and possibly will be for some time to come, classified as a specialty and therefore they could not be successfully handled as other citrus.

In the last three years, I have many times observed good, healthy, active markets become demoralized by limes being offered on the auction market. Further, it is my opinion, from a business standpoint, that this fruit should be combined with avocados and possibly other tropical fruit specialties, in order to cut expense and cost of operation.

In conclusion I would like to say that I have tried to give you my version of the present day aspect on this subject, which in twelve months' time may possibly be altogether different, since this is a comparatively new industry.

THE PERSIAN LIME: IMPRESSIONS OF A REDLAND GROWER

COL. ALVA LEE
Redlands

Although Persian Limes have been grown in the Redlands experimentally for over thirty years, it is only during the past decade that this fruit has been grown successfully on a commercial scale. Consequently there is no set practice which may be accepted as standard for the planting and cultivation of these trees. On the contrary, methods and practices vary with each individual grower. Some of the most common arguments enjoyed at any gathering of Persian Lime growers are the follwoing.

(a) Is the grapefruit or rough lemon stock superior?

(b) Should the trees be planted close together so that the ground is well shaded after five years, or, should they be planted at an ample distance to insure plenty of room for the root system?

(c) Should holes for the trees be dynamited, or, does the modern scarifier break up a sufficient depth of soil?

(d) Is irrigation during the dry season beneficial or harmful? If irrigation is used, should the water be sprayed on to the trees or should the grove be flooded?

(e) Can money be saved and equally good results obtained by using materials rather than a balanced fertilizer?

Although these arguments have been debated loud and long during the past ten years whenever Persian Lime growers have met, none of them has been definitely agreed upon. Probably it will take many more years and careful experiment to reach decisions on any of them. At the present time it frequently occurs that growers using opposite methods attain equally good, or poor, results. This fact in itself makes it evident that there is very little definite knowledge regarding the propagation and cultivation of Persian Limes.

However, an outstanding fact which would seem to be indicative is that certain "back-yard" groves, consisting of half an acre or less, produce a startling amount of fruit per tree. These little groves, which succeed in outdistancing the large commercial plantings per unit, invariably receive materially more care and attention than is given to the larger groves. Without exception, I believe, they are thoroughly irrigated during the dry season. They are pruned carefully and often. They are sprayed whenever spraying becomes necessary, and they are given larger amounts of fertilizer, fifty per cent. organic or better, and generally, but not always, this fertilizer is administered in smaller quantities but more frequently. Because these "back-yard" groves often produce three or four times as much fruit per unit as is raised in the successful larger groves, it would seem that plenty of care and attention, plenty of water during the dry season, and plenty

of organic fertilizer should be adopted as the rule rather than the exception, and this may be proven in the years to come.

It is generally agreed that Persian Limes are more difficult to raise and are subjected to more hazards than any other major citrus grown in Florida. Although equally susceptible to all the common citrus pests and diseases, they are considerably more defenseless against frost and gummosis. Although frost is a minor hazard in the Redlands, gummosis is a serious handicap for this industry. Many experiments are being attempted to control this disease, but there is no control existing which has proven itself. A grower must accept, with what philosophy he can muster, a certain annual loss due to this disease. However, in well tended groves the percentage of loss is not so great as to interfere with the tonnage of production estimated above.

It is probably true that a much greater percentage of loss in Persian Lime groves occurs from the condition of being under-financed than from gummosis and all the other hazards combined. Because the crop varies considerably from year to year, many growers are inclined to consider their maximum income as their average income, with the result that in a year of low yield the grove is of necessity starved, with the usual disastrous outcome. It is a serious handicap to conduct any business which is under-financed, and none where this principle proves itself more quickly than in Persian Lime groves.

Because the Persian Lime was successful commerically from its inception to the present time, the amount of acreage being planted has increased rapidly. Estimates made by the Florida Citrus Exchange on the one hand and by Florida Avocado and Persian Lime growers on the other would indicate that the total Florida production for this year will be double the production of last year.

To the present time this fruit has sold itself strictly on its inherent merits. Although a small amount of publicity has assisted, the amount of money expended from all sources in advertising and publicizing this fruit has been insignificant. Because the fruit is exceptional, consumers have learned of it by word-of-mouth advertising and fast enough so that the demand has increased equally with the increased supply. However, production is now reaching proportions such that an enormous number of consumers must learn of the Persian Lime each year. Otherwise the market will be over-sold.

Experience to date indicates that well-cultivated full bearing groves will produce an average yield of better than two hundred bushels per acre. This being true, the success or failure of this infant industry depends altogether upon expanding markets as rapidly as production is increased. Probably the best chance of securing the necessary expanded markets will be in securing the active support of the chain stores. If certain of the great food chains and drug chains east of the Mississippi were to take hold of this product actively and push it in all their branches during the coming season it would mean probably five or ten times as many Persian Lime consumers as exist at present. A beginning was made with both the food and drug chains last season and negotiations are now under way which promise to attain this objective.

In this connection it is interesting to note that if no lemons were imported into Florida, but if, instead, the lemons were replaced with Persian Limes, then Florida alone would consume the entire production this year. That is to say, more California lemons are imported into Florida than the entire Florida production of Persian Limes. Probably the most hopeful condition pertaining to Persian Lime prospects is that when all the acreage available for Persian Lime production is actually developed and fully producing even in that case the total production, compared to lemon production, will be very small indeed.

Taking it all in all, it is an excellent possibility that increased markets can be kept in pace with increased production and that the Persian Lime will continue throughout the coming years to be known as "the green gold of the Redlands"—but that does depend squarely upon the condition of rapidly expanded markets. Otherwise, it will be a repetition of the grapefruit catastrophe.

BUSINESS SESSION

Dr. Wolfe: At this time we will proceed with the nomination of our Vice-President for next year. You have a large field from which to choose of those who have worked with sub-tropical fruit for years.

Mr. Brooks: I move the nomination of Dr. H. S. Wolfe to be our Vice-President for another year. (Applause.) Nomination was seconded by H. S. Pope. It was moved and seconded that the nominations be closed. Motion carried and Dr. H. S. Wolfe was unanimously elected Vice-President of the Society representing the Institute.

Mr. Brooks: Dr. Wolfe, you are continued in office. (Prolonged applause.)

Dr. Wolfe: I don't know whether to thank you or not. Mr. Brooks is well aware that at the meeting of the Executive Committee I entered a strong protest against re-election. It almost looks, after making this strong plea, as if I have connived my re-election for next year. Now, next year, I am going to ask Mr. Brooks to take the chair while I do the nominating. (Laughter and applause.)

Dr. Wolfe: It is growing late, shall we waive the reading of my paper or do you want to hear it?

Cries from the floor of "Let's hear it." "We want it read."

Dr. Wolfe: All right, then, I will read it.

SOME NEW AVOCADO VARIETIES

DR. H. S. WOLFE
Homestead

At the 1933 meeting of this Society, and at the first session of the Krome Memorial Institute, my erstwhile colleague, Mr. L. R. Toy, described a number of promising new varieties of avocado. There have been no further reports on new varieties in the intervening five years, but so carefully was his list compiled that today there are only a few more to add to it.

Before describing these new varieties, I wish to refer briefly to the present status of the varieties described for you in 1933 as promising. Fifteen varieties were included in that list. Of these, four are now considered worthy of general recommendation—Fuchsia, Booth 7, Booth 8 and Tonnage. Fuchsia is still the earliest commercial variety, and while it lacks quality until August, it can be shipped in late June. We need a better early variety, but until we find it we shall continue to propagate the Fuchsia. The other three varieties above mentioned all mature in the desirable late fall or early winter period, are all fairly heavy bearing, and are all opposite in flower type to the standard Lula and Taylor varieties of the same season, so that they serve to assure pollination.

There is another group of three varieties—Nehrling, Nirody and Steven's Choice, which have definitely proven unsatisfactory for commercial propagation, at least on the lower East Coast. Intermediate between these two groups lie the majority of the varieties described as new in 1933. Their performance has not been such as to warrant extensive propagation, yet they have not shown up so badly that propagation is opposed. Some of them may yet show characteristics of bearing or season which will bring them into first rank favor. This group includes Ajax, Booth 3, Collinred, Collinred Seedling B, Dunedin, Indian River, Nelson, Trappson, Vero and Waldo (formerly Sexton).

The most interesting new development in avocado varieties in the past five years has been the

patenting of seedlings under the plant patent law. Two California growers took out plant patents in 1936, and in 1937 the first Florida avocado variety was patented. This was the Monroe, patented by J. J. L. Phillips of Coconut Grove in the name of J. R. Byrum, manager of his Redland groves. The Monroe is a large elliptical fruit of handsome appearance, with dark green, slightly pebbled, glossy skin. The flesh is yellow and thick, while the skin is fairly thick too, insuring good shipping. The fruit matures from December to February, and has a fat content of 10 to 15 per cent., which is low for that season but satisfactory. Thus far it has been a heavy bearer. The variety is of somewhat academic interest to the avocado grower at present, because Mr. Phillips is not interested in distributing it. While the fruit is larger than is believed desirable for an avocado for commercial planting, its handsome appearance, large amount of meat and excellent quality may more than compensate for the size handicap.

The Simpson avocado originated as a root sprout from a budded tree in the grove of R. L. Simpson in the Redlands. It is also rather large, but is of good appearance and matures in November and December. The fruit is obovate or elliptocal, dull light green in color, with a moderately thick and pliable skin and good thickness of flesh. The fat content is about like the Monroe. It has been under observation for several years and seems to bear good crops, well distributed. Like the Booth varieties, it is in Class B for pollination.

The Avon variety originated as a seedling tree in the grove of W. F. Ward near Avon Park. The parent tree has been characterized by phenomenal bearing, and Mr. Ward is planning to obtain a plant patent. The fruit is shaped somewhat like a Waldin, but matures in December and January. It is of medium size, with smooth, glossy, medium green, thin skin and rather a large seed. The fat content is from 8 to 14 per cent. The heavy bearing proclivities of this attractive variety, with its good appearance and season, more than offset its rather large proportion of seed. It is of the class for pollination.

On the West Coast near Clearwater, a Fuerte seedling has been selected by Mr. Barney Kilgore for propagation. This Kilgore avocado matures in November and December, and like most of the hybrid avocado varieties it is a vigorous grower. The fruit is rather large, averaging two pounds, and is oblong or elliptical in shape, with smooth, green skin and seed of medium size. Several growers on the Pinellas peninsula have been testing the variety and have found it very satisfactory there. The large size is again a handicap, which heavy bearing and good appearance may overcome.

The Steffani variety has been propagated on a small scale in Dade County. The tree has produced large crops rather regularly, and the fruit is of good size and appearance, resembling a small edition of the Winslowson. The season is December and January, and the fat content 8 to 12 per cent. Unfortunately the seed is quite large, and this has probably prevented more extensive propagation. Another variety similarly handicapped by a very large seed but which has recently been propagated on a large scale in the Redlands area is the Booth No. 1. This variety resembles Booth 7 somewhat in general appearance, but is reputed to be even more regular in bearing and is of somewhat larger size. The writer's personal opinion is that propagation of varieties with very large seeds in proportion to the amount of flesh is a step in the wrong direction for the avocado industry. Sooner or later the consumer is going to buy avocados on a food-value basis, and will then discriminate against varieties which give him mostly seed instead of meat.

The most recent seedling of promise which has come to the attention of the writer is one on the grounds of Mr. Willis Hall in Miami. This tree has very attractive fruit which greatly resemble the Pollock but mature during February and March. The size is large, but smaller than Pollock, and the quality is excellent, while the skin is thick enough for good shipping. It is too early to predict the bearing of this tree, and no top-worked trees have fruited yet.

It should be noted that all of the new varieties here recorded bear evidence of being hybrids between the West Indian and Guatemalan races.

It is becoming more and more evident that until such time as some relief can be obtained from unrestrained competition during the summer from Cuban seedlings, the Florida avocado industry must look to these hybrid forms for the profitable varieties for propagation and culture.

(End of Krome Memorial Institute Program)

FURTHER NOTES ON THE PERRINE EPISODE

T. RALPH ROBINSON
U. S. Department of Agriculture
Orlando

The publication in the 1937 Proceedings of the article entitled "Henry Perrine, Pioneer Horticulturist of Florida" has aroused much interest in this noteworthy figure in Florida's early history. As a result the writer has been apprized of additional sources of information which it seems worth while to place on record.

Through Mr. A. V. S. Smith, the present owner of Indian Key, where Dr. Perrine lost his life in the "Perrine Massacre" it has been learned that Indian Key figured in a still earlier Indian Massacre. This occurrence is recorded in a book by John Lee Williams published in 1837 entitled "The Territory of Florida."

"Page 36. Indian Key. On some of the old charts called "Matanzas" (Spanish for Massacre or Slaughter) was distinguished by the destruction of a large crew of Frenchmen by the Caloosa Indians. The vessel of the French was wrecked on the reefs outside of this island, and the crew only escaped shipwreck to be massacred by the savages. It is one mile south of New Matacumbe, and contains about 7 acres. The whole is a Madrepore (Coral) rock, in the clefts of which a few mangroves and flowering shrubs originally took root and afford roosts for innumerable variegated periwinkles that crawled over the branches."

"At this time (1837) much of the island is improved as a garden, the rocky surface being covered by a bed of marl drawn up from the shore. Several buildings adorn the island. A superb hotel overtops them all, erected by the enterprizing proprietor, Mr. Housman. Large stores are supported here, principally by the wrecking business. This little island is become a fashionable resort for invalids from the north, the climate being healthy and pleasant, and the insects being less numerous than in most of the keys."

Jacob Housman referred to was one of those living on Indian Key at the time of Perrine's death. Housman, however, escaped under cover of darkness. About a year later (May 1, 1841) he died through an accident, as recorded on a broken grave stone (observed by the writer) placed over his grave on Indian Key.

Mr. A. V. S. Smith also furnished much of the material for a lengthy article in the Miami Daily News, March 29, 1938, on the occasion of the opening of the highway to Key West. Of particular interest in this article is an official naval report made at the time of the Perrine Massacre which is here quoted.

"'—U. S. Sch. Flirt.

"'Key Biscayne, August 11th, 1840.

"'Sir:

"'I regret to inform you that whilst at anchor here on the morning of the 8th inst. an express reached me from Midn. F. K. Murray, bearing a letter, of which the enclosed is a copy, advising me of the capture of Indian Key by the Indians.

"'The wind and tide being both adverse and the channel way very narrow and intricate. I immediately transferred all the marines and crew of this vessel, but such as were required to navigate her, to the Otsego, and started for Tea Table key, where we arrived during the night, leaving this vessel to follow at the change of tide. On our arrival there we found that the Indians, who proved to be the Spanish Indians, having loaded their boats with supplies of every description from the store of Mr. Housman, the proprietor of the key, had destroyed the town by fire, and retired without molesting our hospital and depot at Tea Table key, distant but one mile, for which the most serious apprehensions were entertained.

"'Mid. Murray had, however, made every preparation for its defense which his limited means would allow. That the Indians were conducted to this attack by some person or persons acquainted with the localities of the key cannot be doubted. Their landing was effected on the outerside of the key, at a point the most remote from

their approach, yet at a corner of the town uninhabited, whilst every consideration, if ignorant of this fact, would have induced them to have landed at a point directly opopsite. Landing where they did their retreat was liable to be cut off, and but for the loss of his guns, there is every reason to believe Midn. Murray would have effected this in the destruction of their canoes, whilst by landing at the opposite point of the key their retreat could have been securely effected on the approach of any danger. Again, negroes were seen among them, who, with others, were heard to speak English, and these last not in the dialect of the negro. This information is gathered from the sufferers by the attack.

"'Lieut. Comdt. Rogers in the Wave had left there but the day before for Cape Romano, carrying with him from Tea Table key every man capable of doing service but five. That this departure was communicated to or looked for by the Indians there cannot be a doubt. In the presence of his force, their invariable policy forbids the belief that they would have ventured upon the attack. In so serious a disaster, when so great a loss of life was to be looked for, it is gratifying to know that it was small. Dr. Perrine, Mr. Motte, his wife and two young children and a lad named Lundy, were killed, the latter drowned in a cistern in which he had concealed himself. Mr. Otis was wounded, and the missing are a negro woman with her two children belonging to Mr. Howe, and a negro child belonging to Mr. Houseman. These were carried off by the Indians.

"'They retired at 2 p. m. of the 6th in 34 boats, six of which had been taken from the key. In some of the boats six, seven and eight people were counted, in none less than four, so that their number could not have been short of 134 people. Those who escaped from the key found refuge in the Schr. Medium, then lying in the harbor. Every convenience and comfort which it was in the power of the officers of this expedition to furnish them in their destitute conditions has been extended to them. I have also furnished them such supplies from the public stores as were necessary. The widow and family of Dr. Perrine have taken shelter on this vessel, awaiting transportation to the North.

"'Respectfully, sir, I have the honor to be

"'John T. McLaughlin,

"'Lieut. Comdt.

"'The Hon. I. K. Pauling

"'Secretary of the Navy

"'Washington City'"

Another important source of information on the Perrine Episode, is an article entitled "Florida's Priority in Plant Introduction" by Joe Hugh Reese, published in the Hollywood Magazine in 1925. This article is unique in having pictures of several members of the Perrine family as well as illustrations showing a Royal palm and Banyan tree growing on the Perrine Grant in 1876. These pictures were obtained through the courtesy of the late Mrs. Sarah W. Palmer of Miami, granddaughter of Dr. Perrine.

The writer in the Perrine article of last year's Proceedings suggested that steps be taken to erect a suitable memorial on Indian Key to Henry Perrine and his ambitious but ill fated enterprise. The owner of the key, Mr. A. V. S. Smith, in a letter to the writer has offered full cooperation in any movement looking toward the erection of such a memorial. It is to be hoped that the interest now awakened may bear fruit and steps be taken in the near future to pay due honor to one of Florida's real heroes.

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STATE PLANT BOARD PROBLEMS

WILMON NEWELL
Plant Commissioner
Gainesville

For some years past, this Society has given little consideration to the subject of major plant pests in their relation to the horticultural industries of the state. Doubtless this has been due to the fact that during this period the growers have not been face to face with an emergency, such as that which existed during the prevalence of citrus canker and, later, during the occurrence of the Mediterranean fruit fly.

Calamities and near-calamities are soon forgotten but what has happened in the past is likely to happen again. True, the same insects and diseases which have twice threatened the very existence of the Florida citrus industry may not recur again—although even this is questionable—but other dangers, unknown and unheard of today, will appear in the picture. Why? Because that is history. There have been incursions of destructive pests of agriculture since the beginning of civilization and there will continue to be during all time to come.

Our growers collectively have, I fear, largely forgotten the trying lessons they learned during the citrus canker and Mediterranean fruit fly experiences. It may be appropriate, therefore, to occasionally review the history of major pest invasions of the state and take cognizance of certain fundamental facts which we must continue to recognize and deal with if our horticultural industries are to escape heavy losses from plant pests in the future.

In this discussion I am not referring to the common grove and garden pests which we have perpetually with us, but only to those with destructive capacity so great that when they do appear it must necessarily be a case of eradicating them or losing an industry. Citrus canker and Mediterranean fruit fly clearly come within this category.

Citrus canker, an unknown and unnamed disease of citrus, appeared in Florida in 1912. So rapidly did it spread and so devastating was its attack on citrus trees that the growers were thrown into a panic. All known methods of checking a plant disease were tried wtihout effect and, in desperation, the growers themselves began burning infected trees in the effort to check its spread. Finding themselves unable to even restrict the spread of citrus canker the citrus industry, ably supported by transportation, banking and business interests, secured passage by the Florida Legislature, in 1915, of the Florida Plant Act, creating the State Plant Board as an agency to deal wtih such emergencies. At about the same time these same groups secured monetary assistance from Congress for the fight against citrus canker.

There followed a most unique and unusual piece of warfare. Federal and state agencies joined with the growers in a strenuous effort to stay progress of the disease. From the beginning there was no thought other than to wipe from the state of Florida every vestige of citrus canker. In other words, to eradicate it, despite the fact that no plant disease had ever before been eradicated. At first the working forces were made up almost entirely of growers. Gradually inspectors were recruited and trained in methods of detecting and dealing with the disease and presently federal and state agencies took over the task.

Many were the harrowing experiences, both for growers and inspectors. No measure proved of value other than the complete destruction of infected trees and those which had been exposed to infection. These the owners gave up with little protest, oftentimes seeing the savings of a lifetime disappear in the roaring flames which destroyed their trees.

Inspectors, on their part, often worked from daybreak until dark, striving desperately to destroy infected trees before the disease could spread from them. Men applied the flaming oil spray until they fell from exhaustion or were overcome by heat; others stepped forward to

take their places. Sundays and holidays were unknown. Inspectors, in endeavoring to locate all trees which had been shipped from infected nurseries, endured trying haardships, traveling miles on foot where other means of transportation were not available, facing hordes of mosquitoes and even swimming creeks and rivers to reach their objectives. Occasionally, also, misinformed grove owners became abusive and on more than one occasion threatened inspectors with violent death. Despite all these difficulties, the inspectors worked ceaselessly on and within a year and a half had the satisfaction of seeing a decrease in the rate of spread of the disease.

At this point, permit me to say that there never has been a more loyal, patriotic army of public servants than this same group of Plant Board employees. And it is small credit to the state of Florida that the compensation they received was less than that of a union carpenter or bricklayer.

This campaign was waged intensively for seven years. By 1924 it appeared likely that canker could be eradicated, and, although not known at the time, the last smouldering spark of canker was snuffed out in 1927. The campaign of eradication cost a total of $2,422,314.63, of which the federal government supplied $1.070,578.25 and transportation and growers' interests $87,369.91. Fifteen thousand, two hundred forty-three grove trees and 342,260 nursery trees were destroyed, and these, together with volunteer services an l the $87,000 just mentioned, constituted the contribution of the citrus industry itself. At this cost, was eliminated from the state a disease which would unquestionably have made citrus fruit growing totally unprofitable, and without profits no industry can survive.

However, he who sleeps in blissful ignorance is likely to awake with a jolt. Citrus canker is not yet entirely eradicated in all parts of the South and it is still prevalent in many citrus growing countries of the world. Only one thing stands between Florida's citrus industry and another invasion of this dread disease and that is the ceaseless and continuous quarantine work of your State Plant Board, supplementing that of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture.

A few years elapsed and in April, 1929, the citrus growers were rudely awakened to the fact that the Mediterranean fruit fly, most dreaded of all fruit pests, had found lodgment in Florida. The experiences of the few months following were indeed distressing ones, both for the growers and the federal and state agencies directing the eradication activities.

Scientists and authorities most conversant with the situation were agreed that at least five years of effort would be required to eradicate the Mediterranean fruit fly—if indeed, it could be eradicated at all. Yet in less than 18 months after its discovery in Florida the federal government pronounced eradication complete and removed (November 15, 1930) from Florida products all restrictive quarantines which had been imposed because of the fly. In all, expenditures in eradicating the Mediterranean fruit fly amounted to $6,852,636.95, of which $6,471,161 was defrayed by the federal government.

Any discussion as to whether the Mediterranean fruit fly did or did not occur in Florida is hardly necessary. The evidence that it was here, that it was firmly established and that adults and larvae occurred by the thousands, is irrefutable. True, there are those who still maintain that because *they* did not see a Meditrranean fruit fly, it could not have been here. Those same individuals would perhaps insist today that there is no Hitler in Germany or Mussolini in Italy, because they have not personally met those gentlemen.

On August 10, 1934, the black fly, previously a citrus pest of magnitude in The Bahamas, Cuba and the Canal Zone, made its appearance in Key West. Immediately your State Plant Board undertook its eradication, even though there had been no instance of its having been eradicated in other countries. This campaign was waged under most difficult circumstances, as the population of Key West, having no commercial fruit industry, was entirely indifferent as to whether the pest might spread to the citrus belt of the mainland and cause heavy losses to the state's largest agricultural industry. It is not likely that any group of public servants was ever subjected to as many vile insults as were the Plant Board inspectors who, for three years, hung doggedly to the task

of eradicating the black fly. Expenditures on black fly eradication (to February 28, 1938) amounted to $154,993.66.

Intensive inspections have been made throughout the campaign, and a particularly close inspection has this week been completed. No black fly has been found since February 26, 1937. Black fly has been eradicated from the Island of Key West.

It is fortunate that this has been achieved coincidentally with the opening of the overseas highway to Key West. With thousands of automobiles and trucks traveling over this highway, no system of quarantine inspection, however rigid, could for long prevent such an insect as the black fly from reaching the mainland.

While the black fly cannot be considered as being in a class with citrus canker or Mediterranean fruit fly, so far as destructive ability is concerned, it is nevertheless true that the establishment of this insect in the citrus groves of Florida would entail heavy expense for additional spraying, as well as, in all probability, very considerable expenditure from public funds in suppressing the pest in abandoned and neglected properties and on non-citrus hosts.

Thus we see that within the past 23 years, the state's citrus industry has twice been saved from what would have been virtual ruin, once through the eradication of citrus canker and again through the eradication of Mediterranean fruit fly. Also a heavy additional expense burden has been averted through the success which has attended the eradication campaign against the black fly.

By comparison, during this same period there have been introduced into some of the New England States the Japanese beetle, European corn borer, Oriental fruit moth and Asiatic beetle. These pests are now firmly established and are causing losses amounting to millions of dollars annually.

One may be inclined to ask, if the State Plant Board's function is, among other things, to keep serious pests out of Florida, why citrus canker, Mediterranean fruit fly and black fly obtained entrance to the state. One answer is that human beings cannot be infallible. The instrumentalities which favor and even expedite entrance of insects and diseases into the United States are colossal and appalling. Every steamship cargo, every passenger from a foreign country and every airplane from foreign shores is a potential carrier of living insects and of disease-infected plant material.

Another answer is that it is often impossible for the inspectors to detect the presence of well hidden plants or plant products which a few people, some of them well informed as to the need and reason for plant quarantines, at times attempt to smuggle into the country. One small piece of infected citrus budwood hidden in the traveler's clothing may be the means of reestablishing citrus canker in Florida, and one smuggled fruit may cause another fruit fly invasion. Then, too, there is the professional smuggler, who smuggles aliens, liquors, jewels and narcotics. Smuggling boats bring in plants and fruits, as well as articles more intrinsically valuable.

Against these perils the Plant Board inspectors wage a steady battle, day and night, year in and year out, inspecting planes, ships, baggage, freight and mail. A list of the insects and diseases which these inspectors have turned back at our ports would strike terror to any grower. The magnitude of their undertaking can be visualized when it is recalled that last year (July 1, 1936, to June 30, 1937) the Plant Board's quarantine inspectors, at Florida ports, inspected nearly 5,000 vessels from foreign shores. Of these, 1,610 were airplanes and 3,004 were boats. In all, 182,866 pieces of baggage and 5,076,432 units of plant material shipped from foreign countries came under inspection. It is a continuous battle against insidious and elusive enemies and like other battles and wars victory cannot always be on one side.

So far as citrus canker is concerned, it was firmly established in Florida before the State Plant Board was created by the Legislature in 1915. How the Mediterranean fruit fly gained entrance to the state will probably never be known.

History repeats itself and will continue to do so. One does not know where the lightning will strike next. In 1936 there appeared in northwest Florida an insect which has come to be known as the white-fringed beetle. It is apparently a native of Argentina and cargoes of various materials have been shipped from the Argentine to

Gulf ports. Nevertheless its method of entering the United States is problematical. The capabilities of this insect for damage are astounding and it menaces the mainstay farm crops of the southern states: corn, cotton, peanuts, chufas, sugar cane and velvet beans. Not enough is yet known about the white-fringed beetle to state definitely at this time if it will be possible to eradicate the pest or if economical control measures can be developed. Its distribution must be determined, its range of hosts, as well as its development, habits and characteristics must be studied. It is not impossible that as a result of this invasion a complete revision of southern agricultural practices may become necessary. This is cited as an example of the dangers to which we are exposed and to point out the necessity for guarding against the unknown as well as the known dangers. I will not take the time to burden you with details of this situation, as it is covered by Professor J. R. Watson's paper before this assembly.

The significant thing is that no crop and no section of the State of Florida can expect to be free from the danger of new and destructive pests. Protective measures to keep them out, as well as to attempt their eradication when they do get in, are just as important to the cotton, tobacco and truck growers as to the citrus growers. Indirectly, of course, every business and industry in the state is equally concerned with the success of these efforts, for without returns from the state's agriculture Florida would be in a sad plight indeed.

Why do we take the opportunity to remind you of these things, facts and considerations which most of you regard from the standpoint of history rather than as vital present and future factors in the welfare of all of us? Simply this. Many of the state's great horticultural leaders who helped fight the battles against citrus canker and Mediterranean fruit fly have passed to the great beyond and a generation of younger horticulturists has largely taken their place. To these younger men citrus canker and Mediterranean fruit fly appear as hazy matters of history —just as does the Civil War. Without careful deliberation they assume that such calamities and near-calamities are things of the past and cannot occur again. Such an attitude is indeed a dangerous one and if persisted in can only be the precursor of trouble to come. Also, present day developments in rapid transportation, particularly by air, increase each year the opportunities for new pests to reach us and, be it said here, America has not yet received more than a very small per cent of the destructive plant pests which occur throughout the world.

If our agricultural industries are to be maintained in a prosperous condition, protective and precautionary measures must be applied on a greater scale than ever before. Another phase of the situation, so far as the citrus grower is concerned, is that each new and additional pest increases the cost of production. It is easily possible for production costs to consistently exceed returns and when that happens the end of an industry is inevitable.

The State Plant Board organization has faithfully served your interests for 23 years and the protection it has given you has undoubtedly been the most profitable form of insurance your industries have ever enjoyed. It will continue to serve you, but it can do so only if supplied with the necessary finances for its activities. We mention this frankly for there is a disposition on the part of legislatures to severely curtail appropriations for the Plant Board during those periods when the state does not appear to be faced with an imminent calamity.

It is necessary to maintain at all times efficient quarantine, grove and nursery inspection and, in addition it is most important that the Legislature provide an adequate emergency fund for instant use in the event of a new and serious pest making its appearance in the state. Such an emergency fund, of $50,000 for each biennium, available for use by joint action of the Governor and the State Plant Board, was appropriated by each Legislature from 1923 to 1935, inclusive. In only three instances was any part of the emergency fund used: $10,000 for suppression of coconut bud rot in 1924, $20,000 for citrus aphids control in 1925-26 and $50,000 in the Mediterranean fruit fly campaign of 1929. Thus, out of $350,000 in emergency appropriations made from 1923 to 1935, inclusive, only $80,000 was used.

However, the 1937 Legislature provided an

emergency appropriation of but $10,000 for the two years. Had not the emergency fund of $50,000 been available for immediate use when the Mediterranean fruit fly appeared in 1929, it is extremely doubtful whether men and resources could have been assembled quickly enough to check the pest before eradication would have become impossible. It is safe to venture the opinion that the $10,000 emergency fund available for the present biennium would be far from sufficient to meet any real emergency should it occur.

The extent to which the Plant Board will be able to serve and protect your interests in the future will be directly dependent upon the extent to which *you* make the Plant Board's responsibility your responsibility and the extent to which you see that it receives both moral and financial support.

SPRAYING AND PRUNING FOR MELANOSE CONTROL

WM. A. KUNTZ and GEO. D. RUEHLE*
Lake Alfred

The control of melanose on citrus, under Florida conditions, has depended for a number of years on two important considerations. The first consideration involves the fact that the fungicides which are most effective in the control of disease require necessary increases in the measures for insect control. This first consideration, therefore, involves joint problems of disease and insect control. The present spray program as published by the Florida Citrus Commission has taken this into account, and it is presented to you with the primary thought that insect control must be fully emphasized in each and all of the schedules. This phase of the problem is not considered in this paper, but is mentioned here, so that all of you may realize that insect control is a part of the complete spray program for any disease control, and under our conditions it necessarily is a very essential part. The second consideration involves the comparative merits and values of spraying and pruning as methods of melanose control. In the study of the literature one is confronted by differences of opinion as to the relative values of pruning and spraying. These differences seem to be due not to the data as expressed, but rather to differences of opinion as to the fundamental reasons for spraying and pruning of citrus under our conditions. The purpose of the present paper is to analyze these two operations and to endeavor to show the relative merits of spraying and pruning as measures for melanose control.

The first record of any control of this disease is furnished by Swingle and Webber (5). In 1894, at Stanton, Florida, they demonstrated that melanose could be controlled by two applications of bordeaux mixture or ammoniacal solution of copper carbonate. They suggested that the first application be made about two weeks after the flowers had fallen, and the second about a month later. In 1911 Fawcett (2) recommended pruning of citrus as the first measure for the control of stem-end rot. A little later Floyd and Stevens (3), and still later Stevens (4) also emphasized pruning as a method for melanose control. Between 1920 and 1927, Burger, DeBusk, and Briggs (1), and Winston and his associates (6, 7) emphasized the spraying of citrus for melanose control, almost to the exclusion of the pruning operations. The above notes are too brief to disclose the underlying reasons for these shifts in recommendations, but it seems logical that after the recommendations of Swingle and Webber, difficulty was encountered in the control of insects following the copper sprays. Floyd, and also Stevens, probably had to take this into account in their recommendations. They also made extensive studies of the causal organism of melanose and traced and described many new stages of this organism on citrus. From these studies, and largely because they had observed a very wide range in the number of stages, they knew that

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spraying must have its limitations for the control of melanose. Because of these limitations Stevens concluded that pruning gave better control of the sum-total diseased conditions than could be secured with two sprays. On the other hand, Winston and co-workers pruned some seedling trees and found that pruning was expensive and unreliable for melanose control. In their spraying experiments they found that one or two applications of bordeaux-oil would produce bright fruit.

This brief review and the personal interpretation of the nature of the studies and the general results, clears up a number of points with regard to melanose control; it makes it clear that the measure which should be used depends upon the purpose. If the sole objective in melanose control is the production of bright fruit, then spraying is the method to be employed. If the objectives are the health and well-being of the tree through the elimination of diseased wood, then pruning is the practice to be emphasized. And finally, if the objectives are broad enough to include both the health of the trees and the production of bright fruit, then effort must be made to maintain a balance in the spraying and pruning operations. A program which includes both spraying and pruning may seem impractical because of expense but research may further clarify the role of the various types of deadwood as producers of melanose spores and eventually simplify the problem of pruning. This dead wood phase of melanose development has always been considered as important, but its study is difficult and complex.

Some of the varying factors in the general field of citrus production show us why this problem is so complex. There are not only the extremes in the seasonal variations from month to month and from year to year which must be taken into consideration, but there is also superimposed on these natural variations a complex of cultural practices. Thus over the complex of rains, temperatures, soil types, etc., on the one hand, there is thrown a greater complex of practices in fertilization, irrigation, cultivation and varieties of citrus so that we find it one of the most difficult problems in plant disease control. This double complex of variable factors must have a great influence on the growth and well-being of citrus trees; and the well-being of the tree is very closely connected with the diseased conditions. This is especially true of such a disease as melanose. The causal organism is constantly associated with citrus under Florida conditions, and it makes progressive inroads and becomes more active on the plants the moment they show signs of weakness.

Cold damage is one of the most serious problems of citrus production for it not only injures the tree, and possibly the crop, but also leaves the way open to melanose infection in injured wood. One of the most important questions in melanose control is, therefore, "How well, and under what conditions, have the trees in your grove carried over winter?" Too many people accept the dropping of leaves and the splitting of wood as the principal effects of cold weather without visualizing the tremendous development of the melanose fungus that is to take place subsequently in the injured wood. Thus, after cold injury to wood, the organism takes hold and it may be several seasons before it can be checked again. In direct attack, the fungus establishes itself on the border-line of wood which is partly injured and yet is striving to live.

In the freeze of December 12 and 13, 1934, the trees in some parts of the state were not only seriously injured, but their recovery was slow and melanose was most active. In March, 1935, on many injured twigs and some of the larger limbs, there was a velvety covering of the tan colored spores often extending a foot or more over the surface area. Younger t wigs were killed outright, but on the older branches many infected areas of *Phomopsis* were established. These "stem-cankers" did not stop growing when the trees started to resume their growth, but rather, they continued to girdle and kill larger branches in the cold-injured trees until after midsummer of 1935. After this severe shock of cold to citrus it was evident that the activities of the melanose organism were not controlled so much by what we could do, but were dependent in part on the normal recovery of the trees.

In March, 1935, some spraying and pruning experiments were tried. One of the observations of results from these experiments is recorded in Table I. These trees were Marsh grapefruit

TABLE I

MELANOSE INFECTION OF LEAVES IN JUNE FLUSH OF GROWTH, AFTER COLD INJURY. MARSH GRAPEFRUIT, SHOWING COMPLETE DEFOLIATION AND ABOUT 50 PER CENT. OF WOOD KILLED. PRUNED AND SPRAYED LAST WEEK IN MARCH, 1935. NOTES RECORDED JULY 26, 27, 1935.

DR. R. L. MCMULLEN GROVE, LARGO, FLORIDA

Plot Nos.	No. of Trees in Plot	Treatments				No. of Twigs Examined	No. of Leaves on these Twigs	Conditions of Leaves; percentages in following classes				No Twigs Died Back
		Approx. Date Pruned	Spray Applied	Concentration of Spray	Date Applied			Shed	Yellowed	Over 300 Lesions	Under 300 Lesions	
1 A	15	3/25/35	Liquid lime-sulfur plus Kolofog	2-100 2-100	3/29/35	75	571	5.6	16.3	30.3	47.8	0
1 B	10	3/26/35	Dupont No. 2	1 2/3-100	3/29/35	90	709	2.0	10.2	40.3	47.5	0
2 A	12	3/26/35	Bordeaux plus bentonite spreader	6-6-100 1-100	3/29/35	75	618	1.8	11.3	15.2	71.7	0
3 A	12	3/27/35	....	....	....	100	792	2.9	23.2	36.1	37.8	0
2 B	5	....	Bordeaux plus bentonite spreader	6-6-100 1-100	3/29/35	100	861	49.8	35.3	11.7	3.2	16
3 B	3	....	....	....	....	50	410	51.5	30.2	15.1	3.2	3

about six years old, in excellent condition before the cold. The entire crop was destroyed, defoliation was complete and about 50 per cent .of the wood had to be removed. As shown in the table some of the common spray materials were applied after the pruning had been done. Since no crop set, the intensity of leaf infection on the June flush of growth was taken as the index of the relative amounts of melanose present in the various plots. The calibrations used were (1) less than 300 lesions per leaf, (2) over 300 lesions per leaf, (3) yellowed leaves, and (4) dropped or shed leaves. Consideration of only the two extremes of this classification reveals that the not pruned and not sprayed trees (Plot 3 B) had 51.5 per cent. of the leaves shed while only 3.2 per cent. had less than 300 lesions on each leaf. The application of a bordeaux 6-6-100 with bentonite spreader and no pruning (Plot 2 B) showed about the same degree of infection on leaves with 49.8 per cent. of the leaves shed and 3.2 per cent. with less than 300 lesions per leaf. Pruning alone, or pruning followed by any one of the standard sprays (Plots 1A, 1B, 2A and 3A) showed a reversal of the preceding figures with only 1.8 to 5.6 per cent. of the leaves shed and with 37.8 to 71.7 per cent. of the leaves with less than 300 lesions to the leaf. The bordeaux spray following pruning decreased the leaf infection slightly but is too likely to cause serious burning of the younger leaves when applied to this type of growth. These experiments emphasize the prime importance of pruning as a first measure of melanose control in severe cases of infections and particularly following cold injury, whereas spraying failed to give any satisfactory control under these conditions.

The immediate injury due to cold in December of 1934, was carried over into a condition of severe melanose infections which was evident as late as February, 1936. The normal cycle of melanose fungus results in an abundance of spores from about mid-April to the end of June, but this was not the case in 1936 for in February of that year we had an abundant leaf infection of melanose on the spring flush of growth. The only satisfactory explanation of this condition is that there were two distinct cycles of melanose developing and releasing spores in citrus trees which were injured by cold. The first cycle, which caused the heavy leaf infection in February, was started by the December, 1934, cold and was superimposed on the normal cycle, which caused leaf and fruit infections during the spring and early summer. There is no doubt that severe cold injury alters the developments of the melanose fungus and these changes can extend into the second season. The effects of lighter degrees of cold injury may be of importance in starting similar melanose developments but no one is prepared to discuss this point at this time.

The examination of the data which were secured from two different spraying experiments carried on in two groves, about 30 miles apart, in the spring of 1935 indicates a number of things. The grove at Babson Park was injured by cold with what may be termed the "border-line" type of injury; some of the trees lost all of their leaves and some of the wood; other trees shed some of the leaves but no wood injury could be observed. Because of this varied cold injury and because of the general lack of soil moisture in this grove in the spring of 1935, the entire grove was off balance. The growth responses were most irregular, some trees had large normal leaves, others had small, "mouse-eared" leaves full of melanose lesions. In this grove there were three distinct blooms and setting of fruits. The sprays were directed to check the melanose infection on the second blooming of these trees and were applied the second week in May. The results of the control of fruit blemish are given in Table II. The results in these plots were so irregular due to variations in growth response, cold injury, lack of soil moisture, etc., that they cannot be properly interpreted. One copper spray (Plot 10) gave as good control as two copper srays (Plot 4); while lime-sulfur showed some degree of control where other sulfurs gave none. These results do not check with other observations.

In direct contrast to these results, are those from the second grove in this same season. A block of grapefruit trees, about the same age as the above, located in Florence Villa, was used. In this block of trees the cold injury was almost negligible, the leaf condition was uniform, the dead wood was relatively abundant, consisting of

TABLE II

EFFECT OF SPRAYING IN CONTROL OF MELANOSE FRUIT BLEMISH, O. D. JAQUESS GROVE, BABSON PARK, FLA. CROP VERY IRREGULAR AND SHORT. (24-26 TREES IN EACH PLOT.) SEASON 1935.

Plot Nos.	Spray Program			No. of fruits examined	Percentages of fruits showing indicated numbers of melanose lesions per sq. in. of surface				
	Materials	Concentrations	Dates Applied		No lesions	1-10	11-25	26-50	More than
2	Bordeaux, bentonite spreader Oil emulsion	3-3-100; ½-100 1.25%	May 9-10 July 1	1000	4.5	49.8	30.2	12.9	2.6
4	Bordeaux, bentonite spreader Bordeaux, bentonite spreader Oil emulsion	3-3-100; ½-100 3-3-100; ½-100 1.25%	May 10 June 4 July 1	1000	18.7	68.4	9.6	3.0	0.3
5	Liquid lime-sulfur Kolofog Liquid lime-sulfur Kolofog Liquid lime-sulfur Kolofog	2½-100; 2-100 2 -100; 3-100 1 2/3-100; 4-100	May 11 June 3 July 3	1000	1.4	46.8	25.2	15.8	10.8
6	Dry lime-sulfur Kolofog Dry lime-sulfur Kolofog Dry lime-sulfur Kolofog	5-100; 2-100 5-100; 2-100 5-100; 2-100	May 13 June 3 July 3	1000	0.4	17.5	22.5	39.9	19.7
8	Bordol-emulsion, bentonite spreader Oil emulsion	1-50 ; ½-100 1.25%	May 9 July 2	1000	2.2	61.1	26.3	8.0	2.4
9	Basic cop., bentonite spreader Liquid lime-sulfur Kolofog Liquid lime-sulfur Kolofog	3-100; ½-100 2-100; 3 -100 2-100; 3 -100	May 10 June 3 July 2-3	500	9.2	61.7	17.8	8.0	3.3
10	Basic cop., bentonite spreader Plus oil emulsion Oil emulsion	3-100; ½-100 0.6-100 1.25%	May 11 July 2	1000	15.9	68.5	12.1	2.8	0.7
12	Check (unsprayed)	....	....	1000	0.3	9.9	25.1	40.7	24.0

the finer twigs, with most of the larger dead wood removed, and the lack of soil moisture had been supplemented by irrigation. Under these more favorable conditions there was a uniformity in the responses of the trees. The early bloom which in this season came in February, was held on the trees in sufficient abundance to prevent a second bloom. There was a light June bloom which was omitted in taking data. The melanose spray was timed very accurately and was applied on April 17th. As indicated in Table III the results are shown from duplicate plots for each copper spray, the duplicates having slightly different follow-up programs. Irrespective of the follow-up, Coposil produced between 85 and 90 per cent. of the fruits with less than 10 lesions per square inch. About the same results were secured in plots 3 and 4 with Basi-Cop. Cuprocide at the concentration of 1 lb. per 100 gals, with lethane and cottonseed oil as spreader-sticker, gave 94 to 95 per cent. of the fruits with less than 10 lesions. Bordeaux in 3-3-100 concentration in plots 7 and 8 showed very close to 95 per cent. of these fruits with less than 10 lesions per square inch of surface. The unsprayed checks showed 17 per cent. of the fruit in this class.

From these comparisons of data secured the same season from these two groves there can be drawn no definite conclusions as to causes of the variations. In case of the materials and sprays there seems to be little variation, excepting the very important fact that in the Florence Villa block the applications could be timed accurately in respect to the single bloom. This was impossible in the Babson Park grove where there were three blooms. In respect to cold injury and its influence on melanose increase, the Babson Park grove was decidedly in the worst condition. Perhaps in these two groves there is illustrated for us a real, and one of the most important, complexes in connection with the melanose control problem. This complex is so common in citrus groves in Florida that we have been ignoring it entirely for years in disease control. There is in Florida a summing up of the totals of effects on trees—which many of us have been considering as natural responses—but which may be described as "cropping strain." It is difficult to define "cropping strain," but in some cases it may be directly traceable to such single factors as, poor light sandy soils, lack of or faulty fertilization, lack of soil moisture, over stimulation to produce abundant fruitfulness, tardy removal of crops, etc. True, every effort is made to avoid these conditions, but all too often the trees are reduced in vitality, vigor and ability to respond after corrections are applied. In the lowering of these tree conditions—from whatsoever cause you wish to choose or name—again, I must point out that you are predisposing the trees to inroads of disease. The melanose fungus is always present on citrus trees in our climatic conditions and under our system of culture, and the moment citrus trees lose vigor or are cropped beyond their capacities, this organism takes hold of the weakened wood, whether twigs, fruit spurs, water sprouts or other parts—and from these inconspicuous places produces an abundance of spores. Perhaps, as seems to be indicated, at least in part, by the conditions in the two groves which have just been mentioned, the combined effects of excessive cropping and cold injury without irrigation when the soil moisture becomes depleted, may be considered as an ideal combination for establishing abundant melanose in any grove.

There is a third condition of citrus trees which has a very important relationship to the abundance of melanose. It has for years been evident that after severe scale infestations melanose becomes of increasing importance in our groves. This point has been stressed, and the need for careful scale control, especially after copper sprays, can not be over emphasized. It is true that certain agencies of natural control of scale insects are present in most groves, but these agencies are natural checks to extreme populations; they must have a certain scale population before they can work. This certain population which is necessary can and does cause a tremendous amount of scale damage, resulting in dead-wood and melanose in considerable abundance in certain seasons. This can be avoided by the regular use of scale control measures.

The foregoing three contributing complexes of conditions; namely, cold injury, "cropping strain" and severe scale infestations, are all very closely tied into the dead wood conditions in any grove.

TABLE III

EFFECT OF SPRAYING IN CONTROL OF MELANOSE FRUIT BLEMISH. SWANN GROVE, FLORENCE VILLA, FLA. CROP REGULAR, TREES UNDER IRRIGATION. (10-12 TREES IN EACH PLOT.) SEASON 1935.

Plot Nos.	Spray Program			No. of Fruits Examined	Percentages of fruits showing indicated numbers of melanose lesions per sq. in. of surface				
	Materials	Concentrations	Dates Applied		No lesions	1-10	11-25	26-50	More than 50
1	Coposil, coll. spreader, oil emul. Dry lime-sulfur, Kolobrite Dry lime-sulfur, Kolobrite	3-100; ½-100; 1 qt.-100 5-100; 3 -100 5-100; 3 -100	Apr. 17 May 14 June 29	1000	22.9	66.1	9.6	1.3	0.1
2	Coposil, coll. spreader, oil emul. Dry lime-sulfur, Kolobrite Oil emulsion	3-100; ½-100; 1 qt.-100 5-100; 3 -100 2-100 (1.5% oil)	Apr. 17 May 14 June 29	1000	17.7	67.6	10.3	3.3	1.1
3	Basic cop., coll. spreader, oil emul. Dry lime-sulfur, Kolobrite Dry lime-sulfur, Kolobrite	3-100; ½-100; 1 qt.-100 5-100; 3 -100 5-100; 3 -100	Apr. 17 May 14 June 29	1000	20.7	67.0	11.0	1.3	0.0
4	Basic cop., coll. spreader, oil emul. Dry lime-sulfur, Kolobrite Oil emulsion	3-100; ½-100; 1 qt.-100 5-100; 3 -100 2-100 (1.5% oil)	Apr. 17 May 14 June 29	1000	25.3	65.0	8.4	1.1	0.2
5	Cuprocide, lethane, cottonseed oil Dry lime-sulfur, Kolobrite Dry lime-sulfur, Kolobrite	1-100; 1 qt.-100; 1 qt.-100 5-100; 3 -100 5-100; 3 -100	Apr. 17 May 14 June 29	1000	25.4	69.5	4.4	0.7	0.0
6	Cuprocide, lethane, cottonseed oil Dry lime-sulfur, Kolobrite Oil emulsion	1-100; 1 qt.-100; 1 qt.-100 5-100; 3 -100 2-100 (1.5% oil)	Apr. 17 May 14 June 29	1000	27.3	67.5	4.0	1.1	0.1
7	Bordeaux, coll. spreader Dry lime-sulfur, Kolobrite Dry lime-sulfur, Kolobrite	3-3-100; ½-100 5-100; 3 -100 5-100; 3 -100	Apr. 17 May 14 June 29	1000	36.3	57.9	4.6	0.8	0.4
8	Bordeaux, coll. spreader Dry lime-sulfur, Kolobrite Oil emulsion	3-3-100; ½-100 5-100; 3 -100 2-100 (1.5% oil)	Apr. 17 May 14 June 29	1000	34.0	61.6	3.4	0.8	0.2
9	Dry lime-sulfur, Kolofog Dry lime-sulfur, Kolofog Dry lime-sulfur, Kolofog	5-100; 3-100 5-100; 2-100 5-100; 2-100	Apr. 17 May 14 June 29	1000	20.1	53.5	14.2	7.1	5.1
10	Check (unsprayed)	....	....	1000	0.0	16.9	22.0	30.1	31.0

They are strong and underlying modifiers of the melanose conditions in this state. In part they tend to answer, "How well and in what conditions did your trees carry over winter?" They emphasize for you that there are some measures which can be taken to avoid serious melanose. They tend to point out and establish the fact that, since there are causes for dead wood in citrus trees, there must be at times a direct need for the pruning of these trees. This pruning may be essential for tree growth recovery, as after cold injury, and at all times, it must be considered as a supplementary part in the control of melanose.

In speaking of melanose control the very narrow phase of control of this disease may be designated. This narrow phase has as its sole purpose the production of bright fruit. If this is to be the limitations of melanose control, then the entire problem takes on its simplest form; for the dead-wood stages where spores are produced can be partly overlooked, the leaf and twig infections may be ignored, and the entire control program can be built around the fruit infection stages. The logical solution would be nothing more than to repeat sprays sufficiently often and to so time them that they would cover the fruit surfaces. If there were no scale complications in this program of citrus spraying, we could repeat the fungicides for melanose control as often as might be necessary, but with the control of scale insects as a necessary requirement, experiences have shown that it is advisable to limit the number of applications of the fungicidal sprays. We therefore assume at present that the limits are not more than two mild fungicidal sprays, in order to make insect control more practical. Under these restrictions for spraying of citrus, let us examine the relative merits of spraying and pruning for the control of the fruit blemish caused by the melanose fungus.

At the Citrus Experiment Station there is a block of 512 young grapefruit trees planted in 1924-25 to four varieties, namely, Excelsior, Duncan, Marsh and Walters. These four varieties are planted in rotation from north to south in 32 rows, with 16 trees (east-west) in each row. In 1932, we subdivided these 16 rows of trees into eight two-row plots. These plots were sprayed and pruned in a regular manner for five years and data are available for the last four years of this field experiment. In the arrangement of these plots the two outside plots were not pruned or sprayed. Next toward the centre on both sides are two-rowed plots which were sprayed each year; these trees were not pruned. The next two rows on each side were pruned each year, but received no fungicidal sprays. The four central rows of the planting were both pruned and sprayed each season. Sulfur dust was used as needed to control mites.

In 1933 the pruning was done strictly according to commercial practice between the dates of January 30 and February 3. No special emphasis was placed on the complete removal of small dead wood. The copper spray for this season was applied on April 24. It consisted of Bordeaux mixture, 3-4-100 with one pound of calcium caseinate added to each 100 gallons of mixture. On June 1-2, a one per cent. oil from a commercial oil emulsion was applied to all of the trees which had received the copper spray in April. All the trees of this planting were sprayed with one per cent. oil emulsion in October of this season to even up the scale infestations in all plots.

The results for the 1933 season are given at the top of Table IV. These results are in the regular type of tabulation for melanose, giving the five classes of numbers of lesions per square inch as found on the upper check of the fruits—as follows: No lesions: 1-10; 11-25; 26-50; more than 50. The disease situation in this young grove was in accord with the findings in other experimental plots, that is, melanose on fruits was not very severe that spring. The check trees which were not pruned and not sprayed showed a no-lesion group of 8.3 per cent. The sprayed trees had 47.5 per cent. of the fruits in this same class. The pruned trees without fungicidal spray had 19.3 per cent. of fruits with no lesions per square inch. The fruits of the trees which were both pruned and sprayed had 86.2 per cent. in this class. If we allow a tolerance of ten or less lesions per square inch of surface for a theoretical first grade of fruits, then the check would show 76.1 per cent; the sprayed but not pruned, 92 per cent.; the pruned but not sprayed 91.5 per

cent.; the pruned and sprayed trees 98.8 per cent. In this season of mild infection and with this grove in its ninth year, the pruning was equal to the spraying for melanose control. The combined operations produced fruits which were very nearly free of melanose blemish; they were about 99 per cent. of approximate first grade.

In the repetition of these operations in 1934 there were a few minor changes in materials and timing. The eight central rows of trees were pruned on February 13-14. There was very little dead wood which had been established during the preceding year and most of this was of the smaller types. The spray for this season was a Bordeaux 6-8-100 with one pound of calcium caseinate to each 100 gals., applied on April 17. On the trees which received this copper spray, an oil emulsion, using 1.3 per cent. actual oil, was applied to the entire planting in that season.

The records from this planting (Table IV, second series) confirm the general observations for 1934, that melanose was very severe as a fruit blemish in that year. The trees which were not pruned and not sprayed (checks) showed no fruits free of lesions; this was also when the trees were pruned but not sprayed. On the other hand the spraying produced 28.5 per cent. of fruits showing no lesions per square inch, and the combined pruning and spraying produced 56.9 per cent. in this same class. In approximate grade, the check trees showed about 20 per cent of fruits which had more than 50 lesions per square inch: these can be considered as culls or cannery fruits. Any and all of the other operations, whether pruning or spraying eliminated this grade entirely. This season the spraying was more effective in producing first grade fruits (less than 10 lesions per square inch); 92.5 per cent. were totaled for this class, after the spraying alone The pruning operation, alone, produced slightly less than 50 per cent. in this class. The combined spraying and pruning again produced 98 per cent. of the fruits in first grade.

In 1935, because of the cold weather and some damage to these trees, especially in the north half of the planting, the pruning operations were not started until late in March. The dead wood was abundant and of the larger types. That spring the Bordeaux was 3-3-100 contentration with 1-200 bentonite spreader. It was applied on April 16th. Oil spray, following this copper, was applied for the first two days in July, at 1.25 per cent. actual oil. To again equalize the scale insect infestations the entire planting of 512 trees was sprayed between November 7 to 9 with a 1.25 per cent. actual oil spray.

In making the records of melanose fruit blemish control for this season, we thought it best to not include the fruits from the north half of these plots; this would eliminate the trees which were severely injured by cold and avoid complications of the direct effects of the operations with this cold injury factor. The results from the south-half of the planting are given in Table IV, series three. In the check trees, not pruned and not sprayed, the fruits with no lesions were about 2 per cent.; the first grade about 42 per cent., and the culls about 11 per cent. Without pruning, the spraying operation as applied this spring, had about 20 per cent. of the fruits with no lesions to the square inch; close to 80 per cent. in first grade, and about 1 per cent. culls. The pruning operation without any fungicidal spray was equal in fruit appearances; about 17 per cent. with no lesions per square inch; close to 82 per cent. in first grade, and less than 1 per cent. culls. The combined pruning and spraying showed about 50 per cent. with no lesions, 98 per cent. first grade, and no cull fruits.

The pruning operations in 1936 were purposely delayed to the last two weeks in March. This time of the year may be considered as a poor time to prune, but we had secured some results in 1935, especially in view of the cold injury, which might be interesting if they could be duplicated. In 1936, the dead wood was practically all of the finer, small twig and fruiting spur types. No effort was made to remove all of it. The pruning was strictly on a commercial basis. The spray applied on April 6th was Bordeaux 3-3-100 plus 1 pound per 100 gallons of bentonite spreader. Following this copper spray these trees received a 1.25 per cent. oil on July 2-7. No oil was applied later that season.

The results for 1936 are the final series in Table IV. Melanose was slightly more abundant on fruits from these trees in 1936 than in 1935. The trees which were not pruned and not sprayed

TABLE IV

EFFECT OF SPRAYING AND PRUNING IN THE CONTROL OF MELANOSE FRUIT BLEMISH. FOUR VARIETIES OF GRAPEFRUIT. TREES 9 TO 12 YEARS OLD. CITRUS EXPERIMENT STATION, LAKE ALFRED, FLA.

Plot Nos.	Treatments					No. of Fruits Examined	Percentage of fruits showing indicated numbers of lesions per sq. in. of surface				
	Date of Pruning	Bordeaux		Oil*			No lesions	1-10	11-25	26-50	More than 50
		Concentrations	Dates Applied	Concentrations	Dates Applied						
Season 1933											
1, 8	....	....	....	....	....	2688	8.3	67.8	15.4	6.3	2.2
2, 7	....	3-4-100	4/24	1%	6/1-2	2516	47.5	44.5	6.1	1.5	0.4
3, 6	1/30 to 2/3	....	....	....	....	2613	19.3	72.2	6.9	1.3	0.3
4, 5	1/30 to 2/3	3-4-100	4/24	1%	6/1-2	1902	86.2	12.6	1.1	0.1	0.0
Season 1934											
1, 8	....	....	....	....	....	4000	0.0	22.1	34.1	24.3	19.5
2, 7	....	6-8-100	4/17	1.3%	6/28-29	4000	28.5	64.0	6.9	0.5	0.1
3, 6	2/13-14	....	....	....	....	4000	0.0	46.8	44.3	7.3	1.6
4, 5	2/13-14	6-8-100	4/17	1.3%	6/28-29	4000	56.9	41.0	1.9	0.1	0.1
Season 1935											
1, 8	....	....	....	....	....	4000	1.8	40.7	25.8	20.8	10.9
2, 7	....	3-3-100	4/16	1.25%	7/1-2	4000	20.3	58.9	14.9	4.7	1.2
3, 6	3/20 to 4/6	....	....	....	....	4000	16.8	65.3	14.2	3.3	0.4
4, 5	3/20 to 4/6	3-3-100	4/16	1.25%	7/1-2	3500	49.4	48.8	1.7	0.1	0.0
Season 1936											
1, 8	....	....	....	....	....	4000	0.0	33.5	27.9	23.5	15.1
2, 7	....	3-3-100	4/6	1.25%	7/2-3, 7	4000	15.4	73.2	9.0	2.0	0.4
3, 6	3/12-27	....	....	....	....	4000	3.4	62.9	21.5	8.8	3.4
4, 5	3/12-27	3-3-100	4/6	1.25%	7/2-3, 7	4000	27.5	70.5	1.6	0.4	0.0

*Applications of oil made to entire planting in fall 1933 and 1935 (see text for details).

showed no fruits without lesions; 33.5 per cent. of these fruits can be considered as first grade and about 15 per cent. as culls. The spraying operation produced fruits with 15.4 per cent. free of lesions; about 88 per cent. first grade, and less than 1 per cent. culls. In the pruning, without spraying, the degree of melanose fruit blemish control was less than in spraying without pruning. The pruning, alone, produced fruits with 3.4 per cent. free of lesions; about 66 per cent. in first grade, and 3.4 per cent. culls. The combined pruning and spraying showed, as in all the previous years, 98 per cent. of the fruits in first grade and practically no culls.

These results of four years experiments for melanose control by pruning and spraying show several important facts. Over this period of time, the culls, or fruits with more than 50 lesions per square inch were between 2 per cent. and 20 per cent. from the trees which were not pruned and not sprayed. In trees of this age, in two seasons of the four, the pruning was as effective as the spraying for melanose control; in the other two seasons the spraying was more effective than the pruning. The spraying seemed to be more reliable for consistent control than pruning. Maximum results in melanose control, close to the production of 98 per cent. of first grade fruits, was secured in all four years when the pruning and spraying were combined season after season. The trees in this experiment were between their ninth and twelfth years in grove planting; starting at the age when melanose begins to be of importance in grapefruit under ridge conditions.

The above series of field experiments does not cover the conditions which are met with in older groves. Unless the older grove is exceptionally well located and handled with reference to soil, climate, irrigation and fertilization, there is bound to be dead wood established. Pruning is expensive under poor grove conditions and it seems to be far less effective in controlling melanose in older trees than in younger trees. This may be illustrated by the results secured at Largo in 1934. The trees in this field experiment were seedling grapefruit in their twenty-fifth year. Dead wood had accumulated for at least ten years. Melanose was as severe in these trees as any place in this state. The details of operations in these older trees in both pruning and spraying are reported for 1934 in Table V. Dormant Bordeaux-oil followed by Bordeaux 6-8-100 in April followed by oil in May, produced, on trees which were not pruned, very slightly better results than the April application of Bordeaux 6-8-100 followed by oil. Pruned trees (plot 4) when sprayed with Bordeaux in April were almost free of fruit blemish. Pruning alone, at least the first season after this operation, (plots 5 & 6) did not greatly increase the bright fruits, although it reduced the cull fruits (with more than 50 lesions) about 25 per cent. Two applications of 3-3-100 Bordeaux were more effective in control than a single application of 6-6-100 Bordeaux. The single application of half strength Bordeaux was less effective than a 6-6-100 Bordeaux, but either was relatively effective in reduction of the cull group of fruits. Under these seasonal conditions in these old grapefruit trees, practically no fruits of first grade were secured from the non-sprayed and non-pruned trees and about 50 per cent. would have to be considered as culls or cannery grade.

After the cold injury in 1934-35, this grove was commercially pruned by the owner, and in 1936 a comparison of several copper sprays in single and double applications was made. The materials, times of applications and results in fruit blemish control are reported in Table VI. This season there were again practically no first grade fruits and about 62 per cent. culls when the trees were not sprayed. A single application of Bordeaux 6-6-100 on April 9th produced 57 per cent. of first grade, with 7.7. per cent. culls. Bordeaux 3-3-100 applied on the same date produced almost the same results. When a second half-strength Bordeaux was applied 4 weeks later the first grade was increased to 85 per cent., and fruits with more than 50 lesions per square inch were eliminated. These results are better than Basic Cop. used with one-half per cent. oil emulsion in single and double applications. The results with red copper oxide with lethane and cottonseed oil are relatively low in the single application. This might be attributed to the breaking of this emulsion, with a settling and coagulation of copper in the oil. before the spraying was completed. Apparently the second application of the red copper on May 7th was sufficiently early this season to be effective

TABLE V

EFFECTS OF SPRAYING AND PRUNING IN CONTROL OF MELANOSE FRUIT BLEMISH. DR. R. L. MCMULLEN GROVE, LARGO, FLA. SEEDLING GRAPEFRUIT TREES, CROP REGULAR. (APPROXIMATELY 100 FRUITS EXAMINED FROM EACH TREE.)

Season 1934

Plot Nos.	Date of Pruning	Spray Program			No. of Trees	Percentages of fruits; showing indicated numbers of melanose lesions per sq. in. surface				
		Materials	Concentrations	Dates Applied		No lesions	1-10	11-25	26-50	More than 50
1	....	Bordeaux-oil emulsion Bordeaux, cal. caseinate Oil emulsion	6-8-100; 1% 6-8-100; 1-100 1 % oil	Jan. 26 Apr. 12 May 28	10	27.6	55.8	12.9	2.9	0.8
2	....	Bordeaux, cal. caseinate Oil emulsion	6-8-100; 1-100 1% oil	Apr. 12 May 28	9	19.2	54.2	21.3	3.7	1.6
3	2- 7-33 1-25-34	Bordeaux-oil emulsion Oil emulsion	6-8-100; 1% 1% oil	Jan. 26 May 28	10	19.7	53.5	22.2	4.1	0.5
4	2- 9-33 1-26-34	Bordeaux, cal. caseinate Oil emulsion	6-8-100; 1-100 1% oil	Apr. 12 May 29	8	62.3	32.7	4.4	0.6	0.0
5	1-27-34	Dupont No. 2	1 2/3-100	Jan. 26	8	0.7	33.0	44.9	18.9	2.5
6	1-29-34	Dupont No. 2	1 2/3-100	Apr. 12	10	0.0	7.9	27.5	39.4	25.2
7	....	Dupont No. 2	1 2/3-100	Jan. 26	9	0.0	0.6	12.5	42.1	44.8
8	....	Dupont No. 2	1 2/3-100	Apr. 12	9	0.0	0.1	8.4	40.7	50.8
1 c	....	Bordeaux, cal. caseinate Bordeaux, cal. caseinate Oil emulsion	3-4-100; 1-100 3-4-100; 1-100 1% oil	Apr. 13 May 4 May 29	9	17.2	62.7	15.4	3.6	1.1
2 c	....	Bordeaux, cal. caseinate Oil emulsion	3-4-100; 1-100 1% oil	Apr. 13 May 29	8	1.4	46.5	33.1	13.7	5.3
9, 3 c	....	Check (unsprayed)	....	....	10	0.0	0.4	9.8	37.2	52.6

TABLE VI

EFFECTS OF SPRAYING IN CONTROL OF MELANOSE FRUIT BLEMISH. DR. R. L. McMULLEN GROVE, LARGO, FLA. SEEDLING GRAPEFRUIT TREES, CROP REGULAR, TREES COMMERCIALLY PRUNED. (1,000 FRUITS EXAMINED FROM EACH PLOT.)

Season 1936

Plot Nos.	Spray Program			No. of Trees	Percentage of fruits, showing indicated numbers of melanose lesions per sq. in. of surface				
	Materials	Concentrations	Dates Applied		No Lesions	1-10	11-25	26-50	More than 50
1, 2	Bordeaux, oil emulsion .... Oil emulsion	6-6-100; ¼% .... 1.25% oil	Apr. 9 .... July 8	19	9.0	48.0	21.1	14.2	7.7
3, 4	Bordeaux, oil emulsion Bordeaux, coll. spreader Oil emulsion	3-3-100; ¼% 3-3-100; ½-100 1.25% oil	Apr. 9 May 7 July 8	18	16.3	68.7	14.1	0.8	0.1
1c, 2c	Bordeaux, oil emulsion .... Oil emulsion	3-3-100; ¼% .... 1.25% oil	Apr. 9 .... July 9	14	5.2	54.2	28.4	11.2	1.0
5	Basic cop., oil emulsion Basic cop., oil emulsion Oil emulsion	3-100, ½% 3-100, ½% 1.25% oil	Apr. 9 May 7 July 8	9	7.2	71.8	17.9	2.9	0.2
6	Basic cop., oil emulsion .... Oil emulsion	3-100, ½% .... 1.25% oil	Apr. 9 .... July 9	10	3.5	58.4	26.6	9.6	1.9
7*	Cuprocide, lethane, cottonseed oil Cuprocide, lethane, cottonseed oil Oil emulsion	1-100; 1 qt.-100; 1 qt.-100 1-100; 1 qt.-100; 1 qt.-100 1.25% oil	Apr. 10 May 7 July 8	10	5.3	65.9	19.9	7.9	1.0
8*	Cuprocide, lethane, cottonseed oil .... Oil emulsion	1-100; 1 qt.-100; 1 qt.-100 .... 1.25% oil	Apr. 10 .... July 8	10	0.4	18.4	26.6	35.4	19.2
9	Check (unsprayed)	....	....	12	0.0	2.4	5.0	30.2	62.4

*In the first application made on April 10, this mixture of material broke from the emulsion before the spraying was completed.

in controlling fruit blemish, for the trees so sprayed showed fruits with about one per cent. culls, and 71 per cent. of first grade. Under these severe conditions for the occurrence of melanose on fruits the second application of a mild copper fungicide seems to be necessary and worth while.

From the studies on melanose control which have been carried forward to the points indicated in this brief paper, there are several generalizations which may be made at this time. Melanose as a disease of commercial varieties of citrus under Florida conditions can not be eliminated entirely from the trees; the causal organism is always present, producing varying degrees of damage from season to season. There are several strong modifying factors concerning the development of this disease which may determine the relative severity of infections from season to season and from grove to grove. Although these three factors have not been studied in great thoroughness; cold injury, "cropping strain," and severe scale infestations should be avoided as far as possible to assist in securing better melanose control. Since these three factors are in a large measure responsible for the establishment of dead wood in citrus trees, there are times and seasons when pruning of a grove is an essential operation to allow the tree to regain its normal vigor after shock and to aid in lessening the abundance of the melanose fungus.

In general, the measures which are used for melanose control may depend to considerable extent on the purpose of the grower. If bright fruit is the sole objective, spraying must be emphasized. This operation is more essential for results in older groves than in younger plantings. If the trees have received severe shocks, which tend to greatly modify the abundance of the melanose fungus, and the objective is not necessarily bright fruit, then pruning is the operation which should be emphasized. There can be no doubt at this time, but that the combined pruning and spraying of citrus trees will produce the best results, both from the standpoint of the trees and also in the production of bright fruit. We are at present attempting to balance these operations for you. Your own observations and practices must be your guides toward the balancing of spraying and pruning under your particular grove conditions.

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GROVE CONDITIONS AND CULTURAL PRACTICES IN THE NORTHERN AREA

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Winter Garden

Groves in the northern area were, as you all know, subjected to very low temperatures in December, 1937. That freeze did considerable damage to fruit, but the damage to trees was relatively small. While it is true that some groves did get frozen and in a few cases young bearing trees were killed back to the bud union yet, on the whole, damage to trees was light.

Apparently the reason most trees withstood the freeze was that they were more dormant than usual due to preceding cool spells and also to the fact that there had been good rains, and soil moisture conditions were unusually favorable.

In January of this year those trees which had been hurt by the cold put out a growth and this growth was killed by the low temperatures in February.

I have referred to the cold spells of this past winter because the grove conditions of today were influenced so much by those low temepratures. As stated, there are some groves now in a very bad condition, but on the whole trees put out a splendid growth this Spring and the condition of trees was better than the average condition at that time of the year.

This winter did not bring to light anything that was not already known, but it did emphasize the value of having trees in good, normal health and as dormant as possible for them to withstand low temperatures. It also emphasized, to the sorrow of some grove owners, that it is a poor policy to have trees overfed with nitrogen during the winter.

I have in mind some groves which had been so fed, especially with nitrate nitrogen, that they were ammoniated and to those trees—that which was to be expected actually happened. They were hit pretty hard in December and they came out too early with a long, tender growth which the February cold got. However, the general picture this Spring was excellent as there was a full flush of growth and a tremendous bloom.

The damage to Spring growth on bearing trees by aphis was light, but the population of mites of all kinds increased rapidly and in some groves considerable damage has been done by six spotted mite, purple mite, and some groves have taken on a light cast similar to nitrogen hunger due to rust mite attacking the foliage. A statement is sometimes made that insects won't be bad following a cold winter, but that has not held true this year.

At the time trees were blooming many predictions for a bumper crop were made but the prospective crop for 1938-39 as judged by the amount of bloom has been cut down considerably by dry weather. At this time, the prospect seems to indicate a full, normal crop, but the dry weather continues and small fruit is still shedding.

The set of fruit so far has been heaviest on grapefruit and lightest on Valencias with midseason oranges ranging in between.

The crop of mature Valencias is being picked for market faster than usual. One factor causing this is that the fruit is losing quality rapidly. Very few crops are holding to a good grade on the tree. Sizes of many crops have become too large with an accompanying coarsening of the rind and drying out.

Aside from the need of rain groves, generally speaking, are now in good, average condition. The Spring flush matured well and shows very little typical Frenching. Of course, this is the season of the year when trees should look their best as many poor soil conditions are not reflected in the tree until the crop is maturing.

CULTURAL PRACTICES

Cultural practices in the northern area include everything that is done any place in the State.

The fertilizer program varies from the use of mixed goods which run high in water insoluble

nitrogen to an opposite program which has no time for natural organic fertilizer materials and which depends almost entirely upon nitrate nitrogen.

The system of cultivation also includes all systems. Some groves are plowed regularly every year, while others are never plowed. Some depend entirely upon a disk harrow and others use nothing but a cover crop chopper throughout the entire year.

Methods of pest control also vary somewhat but they have become more standardized since the advent of the Better Fruit Campaign. Recently, most control work has been done by spraying and less by dusting. By far the greatest amount of spraying done has been the general combination of lime sulphur solution plus wettable sulphur. A great deal of spraying to improve tree condition has been done and with outstanding success, especially following the copper, zinc, sulphur combination.

The grade of fruit in this section has materially improved due to more thorough control measures. This year, however, due to failure to control rust mite during the winter a considerable volume of fruit which had been kept bright was allowed to get rusty and the grade, thereby, was lowered.

In the matter of cultivation there are very apparent trends in the northern area. The disk harrow, which has been improved so much in recent years, is being used more and the acme harrow less. The cover crop chopper is being used more and the mowing machine less. Chopping the cover crop is less expensive than mowing and the light cultivation a chopper gives is considered an advantage, except in cases where it would be inadvisable to stimulate the tree.

While the great improvement in the equipment itself is influencing this trend in cultivation practices a more important factor is that the cooperative caretaking of groves has grown so rapidly in this part of the State. Where a great number of groves which are miles apart have to be cultivated and equipment moved from a central point it is easier and cheaper to use the disk harrow and cover crop chopper than it is a plow, acme harrow and mowing machine.

On the whole less cultivation is being done than in the past. Early varieties are being laid by earlier and Valencias are being worked less in the Fall and Winter.

There is no fertilization program which could be discussed as being common to the northern area nor is there any specific program followed entirely even in more local sections. The only safe statement to make is that some fertilizer is applied every month in the year with the heaviest applications going on in November-December, late April-May, and early June and usually some top dresser in the Spring. This year, however, because of the favorable tree condition very little top dresser was used.

The one analysis most largely used carries 4% nitrogen, 8% potash, and from 6% to 8% phosphoric acid. Next in volume used would no doubt be a 3-6-8 or 3-8-8 with a 4-6-5 or 4-8-5 following and then, in point of tonnage used, would come a great variety of analyses carrying from 2% nitrogen to 10% or 12% potash.

Most of the fertilizer used is in the form of mixed goods and these are generally formulated along the same line as has been customary for many years. That remark applies to most of the fertilizer used, but by no means does it describe all of the fertilizers applied to groves in this area. There is a considerable tonnage which carries out of the ordinary ratios between nitrogen, phosphoric acid, and potash and which is derived largely from chemical materials. Also there is enough acreage fertilized with straight materials so that this system must be considered.

The picture I would like to convey to you is that most of the acreage still gets fed with what may be called "Regular-standard-fertilizers" but that a very significant acreage gets most of its plant food in the form of materials or miscellaneous mixtures.

The information which has been developed by research workers in this State is being put to practical use through the incorporation in fertilizer mixtures of materials shown to have value, but which, until recently, were seldom used. Many direct applications of materials such as magnesium sulphate have been made and the generally improved condition of groves can be traced to the widespread use of information developed through research done by State and Federal men.

The subject fertilization could not be left with-

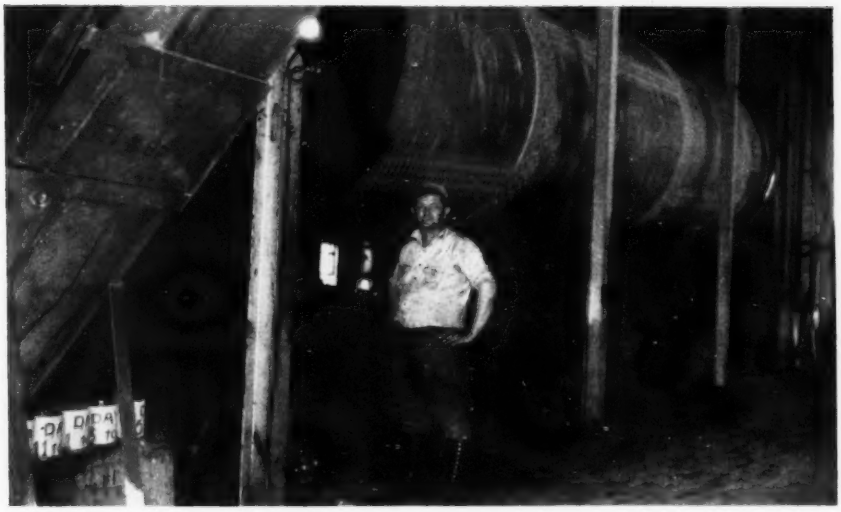


FIGURE 1.
Type of Rotary Dryer used in Florida for Drying Citrus Waste for Cattle Feed.

FIGURE 2.
Interior of Grapefruit Seed Oil Plant showing Expellers.

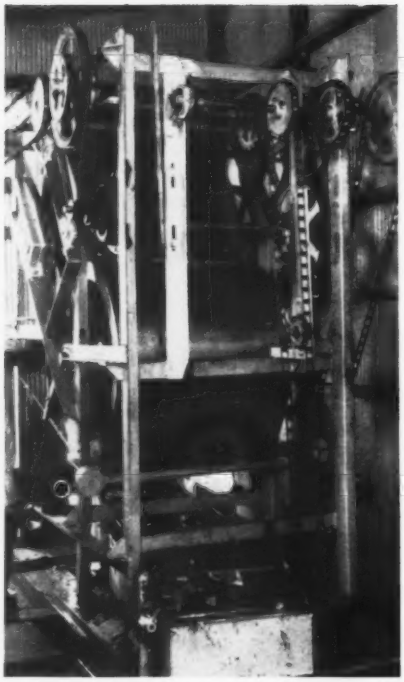
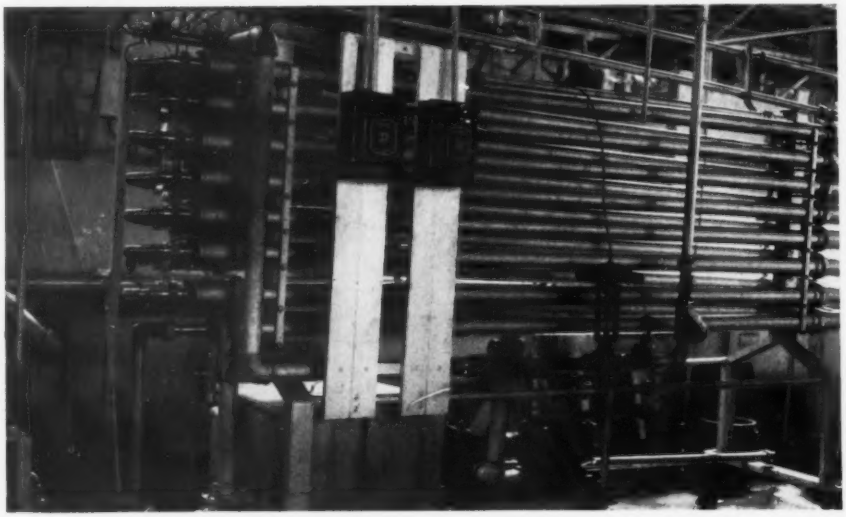


FIGURE 3.
"Pipkin Machine" for Expressing Citrus Peel Oil.

(Below)

FIGURE 4.
A Type of Flash Pasteurizer now used in Florida for Processing of Citrus Juices.



out reminding you that this section, which for years has been a hot-spot for competition among the old established fertilizer manufacturers, has had added to it a number of new cooperative and privately owned fertilizer factories.

Grove conditions are, on the whole, very satisfactory in this northern area and cultural practices followed are improving the quality of fruit each year.

THE CHEMIST LOOKS AT THE CITRUS PRODUCTS INDUSTRY IN FLORIDA*

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Ten years ago, C. P. Wilson of the California Fruit Growers' Exchange, in speaking of the relation of chemistry to the citrus products industry, said "The task of the chemist is to develop new products, to supervise and control the manufacture of such products and to develop outlets for them. A very important function is to sell chemistry to * * * grower owners of the products companies and keep it sold." The chemist has done well his task of selling chemistry to the California citrus grower: citrus by-products made by the Exchange are sold throughout the world. Indeed, the California citrus grower has become so thoroughly sold in chemistry that he is today shipping frozen orange juice to Nassau just off the coast of Florida, and concentrated orange juice into Florida where it is sweetened with sugar, diluted with water and sold as so-called "dairy orange juice."

Why not let it be the task of the chemist in Florida to sell chemistry to the citrus industry of this state? As a step in this direction, many of the more progressive canners are now employing either full or part-time chemists for research and to control and standardize their products. Others are employing consulting chemists. This practice was almost unknown as little as three years ago.

Six years ago the Federal Government established a laboratory at Winter Haven to investigate the utilization of citrus fruits unsuitable for the fresh fruit market because of size or color, and to devise means for recovering by-products from cannery waste. It is the purpose of this paper to review the work of this laboratory, and point out some of the problems yet unsolved and towards which research should be directed.

The most important problem was to find some means of packing orange juice so that its aroma and flavor would be wholly retained during a storage period of nine months to a year. In this we have been partially successful, for by proper extraction, deaeration and flash pasteurization and storage in enamel cans at temperatures of about 60° F., the juice will remain palatable for periods as long as nine months to a year (1). It is admitted it does not have the full aroma and taste of juice from fruit just picked from the tree, but it is a product which would be acceptable to a majority of people not familiar with fresh orange juice as we know it here. That deaeration and flash pasteurization are a distinct improvement over the older exhaust box method of processing both orange and grapefruit juice is attested by Florida canners themselves who are now installing such equipment, and by the fact that the packing of orange juice is increasing. Long before this method was utilized in Florida it was being used by the citrus canners in Texas and California. During the course of our work a new type of deaerator was developed which is cheaper to construct than other equipment of this type on the market (2).

The reason why canned orange juice assumes off-flavors during storage has produced many

*Food Research Division Contribution Number 378.

theories and much speculation. It is quite certain that oxidation due to the oxygen in the air left in the juice after canning plays a role in off-flavor development. But no one knows how much air or oxygen is necessary to bring about these changes. In fact no one has ever published the results of determinations of the amounts of the different gases (carbon dioxide, oxygen and nitrogen) in freshly reamed and deaerated orange juice. Nor has anyone published data on the gases in canned citrus juices of different ages. At the present time, the Federal laboratory is conducting research of this nature.

If you will look in tables indicating the nutritive values of different food materials, you will find that the edible portion of oranges is said to contain 0.2 per cent. fat. This is an extremely small amount, but may have some bearing on the development of off-flavors in canned juice. When fats undergo certain chemical changes they are split into other bodies some of which may have a very objectionable odor and taste. From our preliminary work on the free acids of the fat of orange juice we have found these acids are much higher in old canned juice than in freshly expressed juice. It should perhaps be pointed out these fatty acids should not be confused with the citric acid of orange juice. They are quite different from citric acid. This change in free fatty acid content may be of significance and further work is being carried out with the view of determining the nature of the fat in orange juice. The results may not only be of importance in solving the riddle of off-flavors in canned juice, but perhaps will contribute to a better understanding of the nutritive value of orange juice.

During the past few years the production of cold-pressed orange and grapefruit oil from peels has increased. Many producers soon learned they had difficulty in disposing of some batches of their orange oil because they would not meet the U. S. P. requirements. When this was discovered there was much wailing in the fold and talk that California had stuffed the Pharmacopoeia so only California orange oil would meet the specifications. California is innocent. Not every batch of California orange oil will meet the U. S. P. specifications, but each batch is tested and by careful blending and control of quality the oil not only meets the U. S. P. standards but occupies an important place in the world supply. To learn the variations of Florida orange oil from U. S. P. standards, the laboratory at Winter Haven has requested different manufacturers of oil in the state to gather samples during the year so that we may examine them. At the present time, orange and grapefruit oil are produced in Florida either by grinding the peels of the fruit, or by passing the peels between revolving ribbed drums. In both methods an emulsion is obtained from which the oil is separated by means of centrifuges. An important point here, and which all manufacturers of citrus oils in Florida may not recognize, is that the emulsions cannot be allowed to stand for any length of time before the oil is separated, without impairing the flavor of the oil. The manufacturer of orange oil in Florida does not attempt to blend his different batches to obtain a uniform product, nor does he apply technical control.

After the peel has been pressed as described, there is still some oil left which can be recovered only by steam distillation. The yield of steam distilled oil is higher than cold pressed oil. Steam distilled orange oil is lower in price than cold pressed oil and finds uses where a cheaper oil is desired. Large amounts of steam distilled orange oil are produced in California, but none is being made in Florida, although it could be.

One day about two years ago a man called at the laboratory to ask what we knew about the oil in grapefruit seeds. We showed him the results of our laboratory work and today in Winter Haven there has been established a small plant for extracting the oil from the seeds. Briefly, the method consists of subjecting the seeds to a short fermentation to loosen the slimy coating, drying to the proper moisture content and then expressing the oil. The oil is expressed by means of automatic expellers and the oil obtained allowed to settle and then clarified by pumping through plate and frame presses. The oil thus obtained is light amber in color and possesses a pleasant aroma and a bitter taste. The bitterness may be removed by proper refining which at the same time bleaches the oil until it is nearly water white. The preparation of grapefruit seed oil yields two products: the oil and the press cake.

The true properties of the press cake and its industrial possibilities have not yet been investigated.

About three years of research were spent at the laboratory on the chemistry and preparation of alcoholic beverages from citrus fruits (3). This work has now been stopped. In the fiscal year ending June, 1937, 24,886 gallons of still wine were produced in Florida. Whether the industry will become of importance in the State is a matter of economics.

Feeding tests by Mead and Guilbert of the University of California Agricultural Experiment Station twelve years ago showed orange pulp to have a high content of digestible nutrients (4). The drying of orange peel and pulp was carried out in California ten years ago (5). Recent work by Neal, Becker and Arnold (6) of the University of Florida Agricultural Experiment Station has shown the value of grapefruit cannery refuse and dried orange peel as a feed stuff. The dehydration of cannery residues has now become an important industry in Florida. It has shown a method of disposing with some profit of a material which was formerly an expense and nuisance. But in eliminating one nuisance another has unfortunately been created. This is the liquid pressed from the material prior to drying, the disposition of which has caused public health authorities some concern. The quantity of the liquor may amount to from 20,000 to 50,000 gallons per day. A partial analysis of this material is shown in Table I. From this table it may be seen the waste liquor contains a significant amount of solid matter, including sugars, which subsequently ferment creating obnoxious odors. The material is so concentrated it defies ordinary sewage treatment practice. At the present time it is being disposed of by lagooning which may be considered as only a temporary solution. Some is also being disposed of by trucking away in tanks. It can be readily seen this method is one of great expense. It is not entirely impossible the waste could be fermented with special organisms, not to recover alcohol, but to obtain certain organic acids of technical value. This problem is now being investigated by the laboratory at Winter Haven.

TABLE I

PARTIAL ANALYSIS OF LIQUID WASTE FROM CITRUS DRYING PLANTS

	Plant 1	Plant 2
Total Solids %	6.26	4.88
Ash %	0.50	0.48
pH	8.8	7.7
Pectin %	0.59	0.54
Total Sugars %	2.78	2.44

Another situation of public health significance and of great importance to the canning industry in this State is the disposal of the wash waters from the canneries. These washings contain sugar, pectin and other organic materials which are allowed to flow into lakes. Organic matter is oxidized by Nature so that it may be changed to more stable compounds. The oxygen to carry this out is obtained from the water in the lakes and when this oxygen is consumed there is no longer enough available for fish life. This condition has occurred in some instances in lakes on the shores of which canneries are situated. With the cooperation of the Florida Canners' Association, who have provided funds to erect a small treatment plant, and the Florida State Board of Health, work has been started at the Winter Haven Federal laboratory to find some method of treating the waste so it may be disposed of without becoming obnoxious and without danger to wild life.

Another problem upon which we have been working is the bacteriological aspect of the canning of citrus juices. We have already made several bacteriological counts of raw juice and pasteurized juice in different canneries. Various yeasts, molds and bacteria have been isolated, but have not as yet been identified. Work of this type has been extensively pursued and found valuable in tomato juice production and there is no reason why it should not prove equally valuable in the canning of citrus juices.

Let us now turn to problems which should be attacked but which we have been unable to undertake because of limited funds and personnel of the station:

The question of preparing pectin from grapefruit residue has been a much disputed topic. Vast amounts of pectin are prepared in California by the Exchange, and large quantities are manufac-

tured elsewhere in the country from apple pomace. Nevertheless, during the past year there has been increased interest in this subject as related to the citrus products industry in Florida. It should be realized that the manufacture of pectin requires the highest type of technical control and this means high manufacturing costs. Pectin finds its greatest use in the preserve and confectionery industries. To increase the demand for pectin new uses must be found. Recent work in Germany has directed attention to the possibilities of pectin in the preparation of lacquers, but with the price of pectin at $1.00 per pound and with sulfite pulp and cotton linters (the present basic substances for lacquers) considerably cheaper, there seems to be little hope here. Work has been recently carried out in this country on the use of pectin as a bactericide, and as an aid in promoting the healing of wounds (7). Many clinical tests will be required before any reputable physician would prescribe pectin for this purpose. Should such tests prove successful, the outlet for pectin in this field would be limited. The value of pectin in the treatment of infantile diarrhea is now recognized by all physicians (8). Another use of pectin is the production of suspensions of barium sulfate for use in x-ray work where it is essential that the barium sulfate meal ingested by the patient remain in uniform suspension as it passes through the alimentary canal rendering it opaque to x-rays and disclosing any abnormalities on the photograph taken by the physician. Thus we see progress has been made in discovering new uses for pectin, but outlets which will consume large volumes of the material must be found. Then, too, work should be directed towards establishing the constituents of citrus pectins because very likely there is a difference in combination of these constituents in pectin from oranges and grapefruit. This is rather fundamental, but important to obtain a true picture of this substance.

Orange and grapefruit oils find their use limited to the flavoring field and to an even more limited extent, in the cosmetic industry. Here, too, new uses should be found for these oils to increase the demand. The quantity of flavoring constituents in these oils is extremely small, amounting to less than five per cent. The other 95 per cent. consists of bodies the chemist classes as terpenes which contribute little or nothing to the aroma of the oils. Theoretically, camphor could be made from orange or grapefruit oil. But it would not pay because one would have to compete with turpentine and other raw materials much cheaper than citrus oils. Thus here, too, it is the problem of the chemist to find new and wider uses for orange and grapefruit oils.

Time will not permit a full discussion of the problem confronting the establishment of an important citrus products industry in Florida. Briefly, might be mentioned the need for a search for new uses for naringin, the bitter principle of grapefruit, and for hesperidin, a substance of the same chemical family and found in oranges. Both these substances may be easily and cheaply separated from refuse fruit. New uses for cannery refuse other than drying for cattle feed should be found. The freezing of citrus juices, especially tangerine juice, should be investigated. Some will shudder at the mention of freezing juices recalling the experience in freezing orange juice in Florida about eight years ago. The technical aspects of preserving foods by freezing have made tremendous strides during these eight years and frozen foods have become an important article in the diet in this country, in some instances replacing the fresh commodity. A comprehensive study should also be made of the factors responsible for the decrease in vitamin C content of citrus juices during processing and subsequent storage.

In closing, I should like to quote Professor H. Clark Powell of the University of Transvaal, South Africa, who made a study of the citrus industry in California (9). Powell says "the citrus industry in California is universally acknowledged to be the most soundly organized agricultural enterprise in the world." By proper application of scientific and technical progress there is no reason at all why the citrus industry in Florida could not also be rated as one of the most soundly organized agricultural enterprises in the world.

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RESULTS OF DIFFERENT METHODS OF OIL APPLICATION FOR THE CONTROL OF SCALE INSECTS ON CITRUS

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In the procedure of insect control on citrus trees, in commercial as well as in the research field, the results sometimes vary so much with the same materials that inquiries arise as to what factors may cause such variations. Some of the most common factors which are thought to be the causes of variations are weather conditions, type of trees, the time of year, kind of water used to dilute the spray material, coverage of the tree with the insecticide and the degree of infestation. Only two of the above listed factors will be discussed in this paper; namely, coverage of the tree with the insecticide and the degree of infestation.

When the control of any insect is contemplated one of the first considerations should be to determine the location on the plant where most of the insects feed and whether a contact insecticide or a stomach poison is needed. As it happens, practically all of the insects and mites infesting citrus must be controlled with a contact insecticide. The locations of the major insect pests are as follows: Purple scale on leaves, fruit and limbs; Florida red scale on leaves and fruit; whiteflies on leaves; mealybugs on leaves, fruit and limbs; rust mites on leaves and fruit; purple mites on leaves and fruit; six-spotted mites on leaves only. As noted above, all of the major insects infest the leaves and, with the exception of the purple mites, there are usually more of any one of the above named insects found on the under surface of the leaves than on the upper surface. Since the control of only scale insects is discussed in this paper, figures on other insects will not be presented.

On the average there is a much higher percentage of purple and Florida red scale found on the under surface of the leaves than on the upper surface. The exception to that statement may be in groves where the infestation is light and some residual spray has been applied that has no insecticidal value, or on leaves that have a coating of "sooty mold." Not only are the heavy scale infestations found on the under surface of the leaves but the most heavily infested leaves are found on the inside of the trees, especially of those trees that have dense outside foliage. In one experiment, seven out of eight trees had more purple scale on the under surface of the leaves than on the upper surface. In four different experiments, fourteen out of seventeen plots had more purple scale on the under surface of the leaves than on the upper surface. Those counts were made from three different experiments at Lake Alfred and one experiment at Vero Beach. All of the thirty-six trees in one experiment had more scale on the inside leaves than on the outside ones. A comparison of the degree of infestation of inside and outside leaves of the same trees can be made in Table I. The scale infested leaves are not only found in the inside center of the tree but they are found near the top of the tree as well. In one row of eight trees about fifteen

TABLE I

HEAVY AND LIGHT INFESTATIONS OF PURPLE SCALE ON INDIVIDUAL TREES

Average Number of Living Scale per Leaf

Outside Leaves			Inside Leaves		
Before Spray	After Spray	Per cent. Decrease	Before Spray	After Spray	Per cent. Decrease
99	27	73	219	46	79
43	15	65	192	48	75
41	14	66	167	44	74
30	15	50	185	20	89
14	7	50	154	21	86
6	3	50	102	24	76
8	3	62	45	3	93
5	.8	84	61	1.6	97
5	.4	90	56	.2	99
4	.2	95	18	1	94

Spray was applied from inside and outside of all trees.

feet high, the infestation was as heavy near the top of the tree as it was in the center.

Many growers depend on the entomogenous fungi to control the scale but we find a very small percentage of the scale on the under surface of the leaves attacked by the fungi. During the past year counts were made from over 20 plots in five different groves and in no case was there as high a percentage of scale attacked by fungi on the under surface of the leaves as on the upper surface. Due to the fact that most of the scale insects are on the under surface of the leaves and the more heavily infested leaves are on the inside of the tree, it is necessary, although rather difficult, to obtain a thorough coverage of all the leaves with the scalecide for satisfactory control.

The above findings of the location of the heavier populations of scale are by no means new information. In 1922 W. W. Yothers stressed the importance of thorough coverage of the under surface of the leaves for insect control in the U. S. D. A. Farmers' Bulletin No. 933. In a Florida Agricultural Experiment Bulletin No. 288, published in 1935 by your speaker, it is stated that purple scale, whiteflies and rust mites are found more abundantly on the under surface of the leaves and that thorough coverage was necessary for control. In 1935 at a meeting of the Florida Entomological Society, Mr. L. W. Ziegler presented concrete comparisons of the location of purple scale population on the tree, showing more scale on the under surface of the leaves than on the upper surface, as well as showing that the population was more dense on the inside of the trees. Results obtained by your speaker on more recent purple scale counts follow closely the findings of Mr. Ziegler. Nevertheless, with all that has been done and said about thoroughness of coverage, a high percentage of the insecticides are still being sprayed on the upper surface of the leaves and on leaves near the outside of the tree.

Last summer some preliminary experiments were conducted at the Citrus Experiment Station to determine what some of the weak points of our spraying methods might be. In those experiments the three phases considered were methods of application of the scalecide, the types of trees to be sprayed and the types of spray guns.

METHODS OF TAKING DATA AND THE DESCRIPTION OF THE EXPERIMENTS

The experiment was conducted in a 14 year old grapefruit grove where the average height of the trees was 12 feet, with a lower limb spread of approximately 14½ feet. Some of the trees had a dense covering of foliage with and without a crop of fruit while other trees had medium to sparse foliage. The infestation of purple scale in all plots ranged from light infestations to very heavy ones.

Each plot consisted of a single row of eight trees but in order to help account for variations each tree was considered individually, in other words, a scale count was made from leaves collected from the outside of the tree and also from the inside. Leaves designated as outside leaves were collected by the man picking the leaves from the outside and not more than an arm's length into the tree. Inside leaves were those collected from the central portion of the tree. "Low leaves" were those collected within three feet of the ground and "middle leaves" were those collected three to six feet from the ground. The leaves were picked at random as much as possible, but since none of the current year's leaves were

collected, strictly random picking was not practical. There were several reasons for collecting only the older leaves. The current year's leaves had very few scale on them and since the older foliage was the source of infestation and more difficult to reach with the spray, only the older ones were considered. In one experiment fifty leaves were collected from the outside limbs of each tree and thirty leaves from the inside. When the experiment was repeated in October and all leaves were considered, 100 leaves were picked from each area designated. The leaves were collected in paper bags and the scale counts were made in the laboratory. The leaves in each bag were mixed and drawn out at random in lots of ten. The scale were counted from only one-half of each leaf, the upper and lower sides of the petiole end of the leaves were examined for scale. Counts were made before the application and again about five weeks afterwards.

On June 29 the trees were sprayed with an oil emulsion 1¼ per cent. oil concentration. The same man sprayed all of the trees and where direct comparisons were to be made, all trees were sprayed from the same load. A power sprayer operating at approximately 500 pounds pressure was used. Some of the trees were resprayed in October for a second experiment but the same procedure was followed as in the first experiment.

METHODS OF SPRAYING

The type of trees to be sprayed determines to some degree the method of application. It is difficult to get under or inside of a 10 to 15 year old tree if it has rather dense foliage or if the lower limbs are close to the ground, but nevertheless, it may pay to take a little more time to do that than to get unsatisfactory results with the maximum amount of material. Last summer your speaker was in a 10 year old grapefruit grove where the trees had a dense covering of foliage. Those trees were receiving between 12 and 13 gallons of an oil spray, yet the coverage of inside leaves was not thorough enough to obtain a satisfactory control of scale. The spraying was all from the outside with the idea that the force of the spray would turn the leaves, but a very small percentage of the inside leaves were wet on the under surface. Some of them were damp, but it was doubtful whether there was enough oil deposited to be effective. Most of the trees in the experiment at the Station were low headed and it was necessary for the operator of the spray gun to get down on one knee to spray the inside of the tree.

In the first experiment two methods of application were used, namely, the outside spraying and the outside and inside spraying. The outside spray job was accomplished by the operator spraying the trees from the outside but attempting to reach the inside leaves by sticking the spray gun through the openings in the foliage and swinging the gun around to hit all sides of the tree. The outside and inside method was for the operator to spray the inside of the tree from the inside and then give the outside a fast brushing spray.

Where the spray was applied from the inside and outside compared to the outside method, a 26 per cent. greater reduction of living scale per leaf with only 10 per cent. more material was obtained. On individual trees there was less difference where the foliage was sparse than where it was dense.

TABLE II

METHODS OF APPLICATION

	Gallons per Tree	Per Cent. Decrease of Living Scale
Outside Spraying	8.0	58
Outside and Inside Spraying	8.8	84
Check		+21

In another experiment where the two methods were compared on Pineapple orange trees which were rather sparse of foliage, there was practically no difference in control between the outside and inside spray and the outside spray. The smaller orange leaves compared with the larger grapefruit leaves may also have been a factor in obtaining a more thorough coverage on the oranges.

As stated above, some of the trees in the grapefruit grove were heavily infested and those trees

were resprayed in October and the two methods of application were repeated. At that time none of the trees had so much foliage on them as they did in June and there was not so much difference in results. At that time there was a very low percentage of the scale on the upper surface of the leaves so in two plots the trees were sprayed from the inside only. During the period between the time the oil sprays were applied and the time the scale count was made, a heavy leaf drop occurred in the sprayed plots as well as in the unsprayed one which influenced the per cent. of reduction of the scale population. There was a decrease of 49 per cent. in the check, or unsprayed plot, compared to a 76 to 89 per cent. decrease in the sprayed ones.

There was a reduction of 89 per cent. of living scale on trees sprayed from the inside and outside, 84 per cent. reduction from inside spraying and 76 per cent, reduction with outside spraying. The point to be illustrated here is that where a very low per cent. of the scale was on the upper surface of the leaves there was almost as good control obtained from the inside spraying as with the combination of inside and outside spraying.

Going back to the June experiments there were some other interesting data obtained. There was 10 to 15 per cent. less reduction of scale on heavily infested trees than on lighter infested ones, but where an 80 per cent. reduction was obtained on leaves that had 200 scale per leaf there were still 40 scale per leaf which is too many unless a second oil is applied. Where there were 100 scale per leaf and an 80 per cent. reduction was obtained, or 20 living scale per leaf remaining, the carry-over was only half as much, but, even so, 20 scale per leaf is still too many. Where the initial infestation was only 50 scale per leaf and a 95 per cent. reduction was obtained only 3.5 scale per leaf remained. It can be easily understood why it takes two applications of an oil spray to reduce the scale infestation to a minimum if the scale are allowed to build-up heavy populations on the leaves. See Table I for comparisons of control on heavy and light infestations.

Another interesting point was that in 9 out of 10 trees there was more of a reduction of scale on inside leaves than on outside ones. All of those trees listed in Table I were sprayed from the inside as well as from the outside. The inside leaves received a more thorough coverage because of the sparse foliage compared to the denser foliage on the outside canopy of the trees.

The factor of dense outside foliage preventing thorough coverage, especially when the tree had a crop on it, was well demonstrated from the results in one plot. The decrease of scale control varied with the amount of foliage and crop on the tree. There was a low percentage of kill on trees with a crop of fruit and medium to dense foliage. If the tree had rather dense foliage and no crop of fruit the percentage of kill was higher, and where the foliage was sparse and no fruit, a high per cent. of kill was obtained (see Table III). The oil spray was applied on June 29th

TABLE III

PURPLE SCALE CONTROL ON DIFFERENT TYPES OF GRAPEFRUIT TREES IN THE SAME ROW

Type of Foliage	Size of Crop	Aver. No. of Living Scale per Leaf before Treatment	Per Cent. Decrease After Spray
Dense	Light	29	73
Dense	Fair	14	53
Dense	Medium	10	10
Fairly dense	Medium	4	32
Fairly dense	Medium	3.2	19
Fairly dense	Good	.8	25
Sparse	Light	2.6	92
Sparse	None	2.8	97

Oil spray applied June 29, 1937.

and by that time the fruit was fairly good sized and the weight of it compacted the foliage to such an extent that a good coverage was not obtained on those trees. It is quite possible that a much more satisfactory control could have been obtained had the spray been applied a month sooner or before the fruit had grown to the extent that the limbs were bending.

Another weak spot in our application was the lack of coverage on low limbs, that is, on limbs from the ground up to three feet. In 9 out of 12 plots, or 75 per cent., there was a higher per cent. of kill on the leaves of middle limbs than

on the lower ones. In a count of scale from individual trees there was a higher per cent. of kill on the middle leaves than the lower ones in 29 out of 40 trees or about 72 per cent.

The results obtained from those experiments indicate that satisfactory control of scale might be obtained if control measures are taken before a heavy infestation has built up and a practice made of more spraying from the inside of the trees, especially where there is dense foliage and a crop of fruit.

TYPE OF SPRAY GUNS

The type of spray gun used was also a factor in the control obtained. Some of the results may not have been so much the type of gun used, however, as the size of disc in the gun. In the first experiment four different types of guns were used—the double Boyce gun which had two nozzles and could be regulated to spray a wide mist or a more narrow stream with more force, the single gun which could also be regulated, the four-nozzle broom gun and a 4-foot rod with two angular nozzles.

In Table IV are shown the results obtained where the different kinds of guns were used The highest percentage of kill was obtained where the double gun was used. The single gun rated third, but a small disc was used. In a later experiment when a larger disc was used in the single gun, there was little difference in results between plots sprayed with it and the double Boyce gun. The four-foot rod gun with the two angular nozzles was fairly satisfactory, but was too hard to handle. Nevertheless, in a test made at Vero Beach a more satisfactory control was obtained on trees sprayed by the old type of bamboo rods than with either the double gun or the broom gun.

The lowest percentage of kill was obtained with the four-nozzle broom gun at Lake Alfred as well as at Vero Beach. It is quite possible that if the nozzles were set at an angle and large enough discs were used on the broom gun, a more thorough coverage could be obtained. The nozzles are set at any angle on many of the broom guns in use but no data were obtained for comparisons. There is need for improvement in our spray guns as well as more knowledge of the proper size disc to use with the different types of guns now in use. If small discs are used in the broom type of gun

TABLE IV

CONTROL OF PURPLE SCALE WITH DIFFERENT TYPES OF SPRAY GUNS

First Experiment

Type of Gun	Size of Discs	Gallons per Tree	Per Cent. Decrease of Aver. No. Living per Leaf	No. Seconds to Spray Aver. Tree
2 Nozzle Rod	3/64"	8.7	74	210
4 Nozzle Broom	2-2/64" 2-3/64"	8.6	67	138
Double Boyce	6/64"	8.8	83	108
Single Gun	5/64"	6.5	65	336
Check			+21	

Second Experiment

Double Boyce	6/64"	9.2	82	130
Single Gun	8/64"	12.0	88	150
Check			49	

it is doubtful whether enough spray will be deposited to be effective on leaves near the top of the trees. If large discs are used, more material than is necessary is likely to be used if careful spraying is practiced. Larger discs can be used to advantage in the single or double type of gun without so much waste as the number of nozzles are cut down and they are more easily handled on the inside of the trees, the stream or spray can also be regulated on those guns.

If more thorough spraying is practiced, that is, thorough spraying from the inside of the tree, some caution should be used in the amount and kind of materials used, especially with oil sprays. If a quick breaking oil is used, the operator should not keep the gun directed at any one part of the tree for any length of time since a heavy deposit of oil will accumulate and may injure the foliage and twigs. The grower should consult the salesman or field man representing the company manufacturing the oil as to the specifications and kind of oil that is being purchased.

LIMITATIONS OF THE BARK-SCRAPING METHOD IN THE CONTROL OF GUMMOSIS AND PSOROSIS OF CITRUS

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The fact that psorosis in the early stages usually extends only to the middle layer of bark so that the inner bark and the cambium remain healthy for a time gave rise to the idea of endeavoring to control this disease by systematically scraping off the outer layer of diseased bark. When attention was called to this fact by Webber* in a brief note on this disease in 1902, he stated that he had observed it to yield to treatment by scraping off the outer diseased bark and applying crude carbolic acid. As a result of extensive trials started more than 15 years ago, Fawcett and others have reported marked beneficial results for this bark-scraping method of treatment of psorosis in California. It was also found to be of value in treating the shell-bark disease of lemons in that state. The experiments in California have shown the importance of scraping the bark not only over the area visibly affected, but also 6 to 8 inches above and below and from 6 to 8 inches on either side of the margin of the lesions in case they do not extend around the attacked trunk or limb. The scraping should be just deep enough to remove only the dark surface layer and expose the white inner bark. Too deep scraping is liable to result in the death of the inner bark and cambium layer. A large number of disinfectant applications have been tested in California, both with and without scraping, but a thorough job of bark scraping has been found to be much more important than the use of any kind of fungicide or disinfectant alone. Workers in other states and countries have likewise reported beneficial results from this method of treating psorosis and also some forms of gummosis.

In the spring of 1927 the writer began work to determine the value of this bark-scraping method of treatment under Florida conditions, not only for the control of psorosis but also for the forms of gummosis on grapefruit and tangerine trees, which are very similar in many respects. Blocks of trees were selected in three medium-aged groves at Bonaventure and at Courtenay and Lotus on Merritt Island, where bad outbreaks of gummosis and psorosis occurred under a wide range of soil and other conditions. In the spring of 1928 the work was extended to include a block of grove at Cocoa on a still different type of soil. The trees in each block were mapped and descriptive notes taken on the condition and development of the disease on each tree at the time of treatment. Although the causes of these respective bark diseases were not known, it was thought

*Letter on psorosis. In Hart, W. S., and Carter, J. C., Diseases and Insects of the Citrus. Florida State Hort. Soc. Proc. 15 (1902): 48.

that growers would be more interested at the start in anything which might offer a means of curing these troubles than in probably waiting several years to learn the exact causes and then possibly not having a practical remedy. It was also thought that by inspection of each diseased tree and treatment, where necessary, for a number of years an insight could be gained in regard to the rate of development, nature, behavior, and persistence of these bark diseases, which would prove of considerable value. Since it was not known at the time whether the treatment might prove effective in advanced cases of these respective bark diseases, all diseased trees in these grove blocks were included, regardless of the severity of the disease. The inspection and treatment of each of these trees, where necssary, was repeated each year through 1937, so far as they continued living or were considered worth retreatment, with the exception that in 1929 those in the grove at Courtenay were omitted on account of emergency work in the Mediterranean fruit fly campaign. Thus, with the exception of this grove and the one at Cocoa where the work was not commenced until 1928, the data in regard to the development and behavior of these bark diseases covers a period of 10 years following the initial treatment. As a rule, the inspections and retreatments were made in April, May and June, but occasionally earlier. The final inspection of the trees in the groves at Cocoa, Courtenay and Lotus in 1937 was not made until late in August, so that more than a year elapsed between this and the previous inspection and retreatment.

It became apparent early in the work that the bark-scraping method of treatment had a decided practical value for the control of both gummosis and psorosis. However, it is never safe to judge the value of any method of treatment of such bark diseases until after a few years have elapsed. The importance of doing a thorough job of bark scraping, not only so far as the lesions extend, but also well in advance of their apparent limits, was demonstrated very conclusively early in the work. In cases where the lesions were not scraped sufficiently far in advance, both gummosis and psorosis almost invariably continued activity. It has been the experience of the writer, in examining numerous trees treated by growers in different parts of the State, that they frequently do not get the results that may be expected from the method because they neglect this most important precaution. It has also been his experience that lesions which are not treated because they do not appear active, frequently resume activity a year or two later, as these bark diseases appear to remain quiescent for a time under certain conditions. Some growers in Florida prefer to remove the surface layer of bark with a wire bristle brush. When carefully done, this appears to give very good results.

A considerable variety of disinfectant pastes and washes have been applied to scraped lesions to test their comparative value. Among these may be mentioned Bordeaux paste, lime and sulphur paste, lime-sulphur paste and washes, zinc sulphate-lime paste, caustic soda-Bordeaux, caustic soda-Bordeaux with lime-sulphur, Avenarius "Arrow" Carbolineum (a commercial carbolineum of low phenol content), Avenarius Dendrin (a commercial preparation emulsified to mix with water) at dilutions of 10 and 20 per cent. and without dilution, Humisol and Preservitol (two commercial beech wood creosote preparations, the former emulsified to mix with water), Protexol (a commercial carbolineum), Black Sambo (a commercial material containing neat's-foot oil, formerly advertised in California), Nitrose paint (a commercial heat-resisting paint for preventing rust on metal), and "Gummosis No. 1," "Gummosis No. 2," and "Gummosis No. 3" (commercial preparations containing Venezuelan asphalt and also aluminum paint in one case).

The last four of these preparations did not have any particular value for the purpose but were not injurious. Both the Black Sambo and Protexol proved highly injurious, the latter certainly belying the implication of its name. Humisol and Preservitol, Avenarius "Arrow" Carbolineum, and Avenarius Dendrin did not prove injurious, even when used at full strength, but apparently were no more effective for the purpose than lime-sulphur. The various home-made pastes and washes enumerated all proved very satisfactory, but lime-sulphur appeared to be the most effective in expediting scaling and exfoliation of the outer layer of bark, which is the ob-

ject of the treatment. Thick, heavy, sealing materials tend to retard this process, and thus are not desirable. Moreover, such substances, particularly when black, have the additional disadvantage that they obscure the bark and render it difficult to see what is taking place. Owing to its apparent superiority, lime-sulphur was the principal material used. It has the additional advantage of being cheap, readily mixed for use, and available in all localities. By reason of the convenience of storing, the writer used the dry lime-sulphur, mixing it for use at the rate of one-half pound per gallon of water. Where the commercial liquid lime-sulphur is used it is recommended that it be diluted with about 6 parts of water since injury to the bark sometimes results from using it in more concentrated form.

The writer wishes to stress the fact that, as proved true in California, the application of a fungicidal paste or wash to the scraped areas of bark appears to be a matter of secondary importance to a thorough job of bark scraping. It is believed, however, that under Florida conditions of a moist, humid climate, with frequent periods of prolonged rainfall, such an application is of particular value for the prevention of infection of the newly scraped areas of bark by various organisms. Moreover, it is likely that a fungicidal paste or wash may prove of value in killing the various organisms or virus which may be associated with the diseased areas of bark. The writer has had occasion to observe over a period of several years gumming areas of bark painted with a variety of substances without first scraping the bark, but in no case has he observed any particular worth-while results unless the material applied induced the outer bark to crack and scale off. It appears that it may be possible to accomplish a fair control of these bark diseases by the application, without extensive scraping or brushing, of some penetrating material that does not injure the inner bark. Within the last few years growers in some sections of the State have claimed beneficial results from spraying unscraped lesions with caustic soda-Bordeaux, an old-time fungicide used a generation ago in the Arcadia section for foot-rot control. In some instances they have added 5 gallons of commercial liquid lime-sulphur to the 5-5-50 formula. However, the writer has not had the opportunity to follow up these treatments in detail.

The value of the bark-scraping method for treating psorosis and our Florida forms of gummosis lies in the fact that the removal of the waterproof outer layer of bark induces the formation of a cork layer within the inner bark, which results in the drying out, cracking, scaling, and exfoliation of the outer bark cut off by the formation of this internal cork layer, thus tending to eliminate the disease where it has not become too deep-seated. A superficial scraping of the bark suffices to accomplish this. While it is most important that the scraping be thorough in extent, it should never extend more than a third of the way through the bark.

The results of the bark-scraping method of treatment for gummosis and psorosis are summed up in the following.

GROVE AT COURTENAY ON MERRITT ISLAND

In this grove, all trees on which bark diseases were apparent in a block of 475 trees were treated, beginning in 1927. Inspection and retreatment, where necessary, was repeated each year until 1937 inclusive, with the exception of 1929. This block consisted chiefly of Pineapple oranges with some scattered Florida Common grapefruit. With the exception of a few rows on grapefruit stock, all were on sour orange stock. The soil is Norfolk fine sand, in which the trees occasionally suffer more or less from drought. Psorosis occurred scattered throughout this entire block of 50 short rows and several trees exhibited bad cases of this disease in which the trees had begun to decline at the beginning of the treatment.

A total of 64 trees, comprising 52 oranges and 12 grapefruit were treated for gummosis and psorosis. Results obtained at the end of the tenth annual inspection and treatment in 1937 showed that, of the 52 orange trees treated for psorosis, 21 either had been removed or discarded as worthless because of decline from this disease. Within 4 years after the initial treatment, 15, or 71.4 per cent. of these 21 trees, all of which had fairly bad to bad cases of psorosis to start with, were either removed or had declined to the point where they were no longer worth treating. It did not prove possible to cure a single one

of these trees by the bark-scraping method of treatment.

On the other hand, the initial treatment in 1927 sufficed to arrest the development in most cases of the other 31 trees which had chiefly early to slightly advanced stages of psorosis. In many instances, however, new psorosis lesions developed later at points more or less remote from the areas treated originally. These later developments of the disease appeared to be the result of new outbreaks rather than cases of the disease persisting in the trees. In some instances the new outbreaks of the disease did not occur until 5 or more years after the original treatment. On some trees there was but a single new outbreak, while in others there were two or three. In nearly every instance these new outbreaks of the disease occurred in the crotches of the limbs or trunk divisions, which seems to be a common place for psorosis to start. As in the case of the lesions originally treated, the development of these new lesions appeared to be readily checked in most cases by a single treatment. One of these trees, which had but two small lesions in limb crotches to start with, was removed in 1936 on account of decline from blight, after the psorosis had been controlled. At the conclusion of the experiment with the tenth inspection in 1937, only a single one of the 30 orange trees remaining required retreatment and this exception was due to a recent new outbreak of psorosis. Of the 29 orange trees not requiring any retreatment at the tenth inspection in 1937, 2, 7, 1, 1, 3, 1, 4, and 10 had not shown any need of treatment for the past 1, 2, 4, 5, 7, 8, and 10 years, respectively. The results of the treatments for the orange trees in this block of grove are summarized in Table I.

Of the 12 grapefruit trees treated in this grove in 1927, 3 appeared to have typical cases of psorosis and the other 9 gummosis. Of the 3 grapefruit classed as having psorosis, two, each of which had a prominent lesion on a main limb in 1927, were removed in 1937 on account of decline from this trouble. The other, which had only a small lesion on the trunk in 1927, was discarded as hopeless in 1933 and removed on account of decline from psorosis in 1935. For some unknown reason the disease progressed in this tree with unusual rapidity. Of the 9 grapefruit classed as having gummosis, one had 3 lesions and the others each a single small lesion in 1927. In a few of these the disease appeared to be checked and then broke out again intermittently. One of these remaind free from the disease for the last 2 years of the experiment, 1 for the last 3, 1 for the last 4, 3 for the last 7, 1 for the last 9, and 1 since the original treatment. The other remained free from gummosis for 6 years and then was removed on account of decline from blight in 1937.

During the 11-year period covered by the inspections and treatments, 35 additional trees, comprising 9 grapefruit and 26 orange, in this block of grove were added to the list of trees being treated for gummosis and psorosis. In some of the grapefruit trees the trouble appeared more typical of gummosis than of psorosis, but in the balance of the grapefruit trees and all of the orange trees it appeared to be typical of psorosis. In most cases but slight outbreaks of the disease occurred, but in a few rather advanced cases of the disease had developed. The treatment of these trees began as follows: 2 in 1928, 4 in 1930, 14 in 1931, 4 in 1932, 4 in 1933, 1 in 1935, 4 in 1936, and 2 in 1937. Of these 35 trees a single tree each of grapefruit and orange was removed on account of decline from psorosis. The former, in which the disease was first noted in 1931, was removed in 1937; the latter, in which the disease was first noted in 1930, was removed in 1936. As in the case of the trees originally treated in this block of grove for psorosis, a few required additional scraping where the disease was not checked completely by the first treatment, and in several new outbreaks of the disease appeared in limb crotches at points other than where the originally treated lesions developed, from one to five years after the disease appeared to be completely checked by the original treatment. Of the trees treated prior to 1937, with the exception of 4 trees on which active lesions of the disease were apparent in the final inspection of this year, all appeared to exhibit complete control of the disease. In 16 of these no further treatment was required since the original treatment. One of the trees in which the disease was still active was a replant in which a well-developed case of psorosis appeared at two points on

TABLE I

SUMMARY OF 10 YEARS' TREATMENT OF 52 ORANGE TREES FOR PSOROSIS IN GROVE AT COURTENAY ON MERRITT ISLAND, BEGINNING IN 1927

Year of Inspection and Retreatment	1928	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	52	48	43	37	36	32	31	31	30
Trees not requiring retreatment	23 or 44.2%	26 or 54.2%	27 or 62.8%	28 or 75.7%	29 or 82.2%	31 or 96.9%	21 or 67.7%	28 or 90.3%	29 or 96.7%
Trees retreated because disease not checked by previous treatment	27	14	4	6	2	0	0	0	1
Trees retreated because of lesions developing at new points	2	4	6	2	1	0	10	2	0
Trees removed or discarded on account of decline from psorosis	4	5	6	1	4	1	0	0	0
Trees removed or discarded on account of decline from blight	0	0	0	0	0	0	0	1	0

TABLE II

SUMMARY OF 11 YEARS' TREATMENT OF 54 GRAPEFRUIT TREES FOR GUMMOSIS IN GROVE AT LOTUS ON MERRITT ISLAND, BEGINNING IN 1927

Year of Inspection and Retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	54	53	53	53	53	53	49	46	46	46
Trees not requiring retreatment	14 or 25.9%	36 or 67.9%	32 or 60.4%	46 or 86.8%	42 or 79.2%	38 or 71.7%	30 or 61.2%	34 or 73.9%	39 or 84.8%	31 or 67.4%
Trees retreated because disease not checked by previous treatment	39	7	8	4	5	6	5	8	4	5
Trees retreated because of lesions developing at new points	0	10	13	3	6	5	11	4	3	5
Trees removed or discarded on account of decline from psorosis	0	0	0	0	0	0	0	0	0	0
Trees removed or discarded on account of decline from blight, etc.	1	0	0	0	0	4	3	0	0	2

limbs near the base of the crown in 1936. This tree had been set out to replace a tree that had been removed on account of decline from blight and could not have been planted for more than 4 or 5 years at most when the disease was first noted in 1936. Cases of psorosis are of very rare occurrence on such young trees. In the instance cited the disease undoubtedly had already become systemic and impossible to control.

While it did not prove possible to cure a single one of the trees in this block of grove which had fairly bad to bad cases of gummosis or psorosis to start with, the success of the bark-scraping method of treatment in nearly all cases of both these bark diseases, where they were still in an early to slightly advanced stage when the treatment was begun, was very gratifying.

GROVE AT LOTUS ON MERRITT ISLAND

In this grove all trees in which bark diseases were apparent in a block of 12 rows of 17 trees each were treated, beginning in 1927. The trees treated comprised 54 grapefruit, 59 tangerines, 3 mandarins, and 8 oranges. With the exception of the grapefruit, most of which was on grapefruit stock, all the trees were on sour orange stock. The soil is chiefly Gainesville and Dade sands, underlaid by coquina limestone. Several trees, chiefly in the tangerine block, had been removed and replanted on account of decline from blight when the work was begun.

Of the 54 grapefruit trees treated in this block of grove in 1927, all the bark disease appeared to be typical gummosis. Forty-nine of the cases were classed as slight to somewhat advanced, with the number of lesions varying from 1 to 5 on the trunk and main limbs. The gummosis on the remaining 15 trees was classed as bad on 3 and moderate on the others. In many instances gummosis had developed about the callus formed over old, more or less completely healed, pruning wounds. In these cases the wood did not appear to have been protected and nearly all wounds showed more or less evidence of decay. The majority of these trees required retreatment in 1928. In the subsequent years, however, only a few of these trees required retreatment because of activity of the disease in the original treated lesions, although a number required retreatment because of gummosis developing at new points. In 2 trees no retreatment was required during the entire 10-year period after the original treatment in 1927, and in 6 trees no retreatment was required after the first one in 1928. In the other trees the disease showed activity, either at old or new places, intermittently in one or more years, sometimes after a few years of inactivity. During the 11-year period covered by the experiment, 10 of the treated grapefruit trees were removed as follows: 1 in 1928 as a result of root rot and decline following water injury, 4 in 1933, 3 in 1934, and 2 in 1937 as a result of decline from blight. None of the latter 9 trees exhibited bad cases of gummosis.

Of the 44 grapefruit trees remaining at the conclusion of the experiment in 1937, 31 showed no evidence of gummosis, 5 were retreated because of new outbreaks, and 8 were retreated because of gummosis being active at places treated previously. Only one of the latter group of trees appeared hopeless and that was one in which gummosis was just starting from a series of tiny holes in the main limb crotch when the initial treatment was made in 1927. In this case bird shot were found imbedded in the wood and the grower recalled having fired his shotgun one night at a pestiferous cat. The gumming advanced rapidly on this tree despite the treatments, which were required each year except 1931. After a few years the entire trunk became involved by the disease and the bark died on one side and the wood became extensively discolored. The results of the treatments for the block of grapefruit trees in this grove are summarized in Table II. With the exception of the tree just cited, the bark-scraping method of treatment appeared quite beneficial in controlling gummosis.

Of the 59 tangerine trees treated in this grove in 1927, practically all had extensive cases of gummosis, involving much of the lower trunks and the bases of the main trunk divisions. In many instances lesions occurred also at points higher up on the limbs and the majority of these trees required extensive treatment. All of these trees likewise required treatment at one or more points in 1928 and many of them required extensive retreatment. Of the 57 trees remaining in 1929, all but 2 required retreatment because of

the continued activity of what appeared to be the original lesions. In the succeeding years the progress of the disease appeared to be well checked where first treated but frequently the disease continued to be active at some point or points at the margins of previously treated lesions or at new places. In the fourth inspection and retreatment in 1931 it was observed that new bark infections frequently began to develop in the old healed bark of the lesions first treated in 1927. The reduction of the number of trees requiring retreatment each year was largely minimized by both this and the development of lesions at new points, chiefly on the upper limbs where the disease did not occur previously. As a result of the frequent outbreaks of this disease at new points and its reoccurrence 3 to 4 years later in the older areas previously treated, most of the trees that were not removed on account of decline from blight continued to require retreatment each year, despite the progress of the disease being nicely checked in most of the areas previously treated.

In the analysis of the results it was found that 8 trees required retreatment each year from 1928 to 1937 inclusive because of activity at one or more points that had been treated previously. In fact, most of the trees required retreatment each year since the original treatment in 1927, so far as they did not succumb to decline from blight, either because of failure of the previous treatment or treatments to control the disease or on account of bark infections developing at new points not previously treated. Only in a few instances did trees go for two consecutive years without requiring retreatment and only two trees went for more than 3 consecutive years without requiring retreatment. One of these required no retreatment for the last 8 years of the experiment and the other required none for 5 consecutive years and then was removed on account of decline from blight. The results of the treatments for the block of tangerine trees in this grove are summarized in Table III.

With the exception of a single tree, whose loss possibly was attributable to the bark disease and the 15 that declined from blight, these tangerine trees continued to be very productive throughout the 11-year period covered by the experiment. The treatment proved very effective in checking the disease but new gumming areas developed so rapidly that the results make a very poor showing when considered from the standpoint of the repeated retreatments required. The few mandarin trees in this block of grove appeared to be much more resistant to this bark disease than the tangerines.

Of the 8 orange trees treated for psorosis in 1927, all but one exhibited only early stages of this trouble. Three of these trees required no further treatment during the next 10 years they were under observation. Another required only a little additional retreatment in 1928 to check the development of the disease. In two other trees where the original treatment arrested the disease, one required retreatment in 1933 for a small lesion that developed at a new place, and the other required retreatment in 1930 and again in 1931 for the same reason. Still another tree required retreatment in 1929 and was removed the following year on account of decline from blight. The remaining one of these 8 trees, in which psorosis involved the small trunk and extended up on the main limbs, exhibited no further evidence of the trouble after the first treatment in 1927, but was removed in 1935 on account of decline from blight. In the few orange trees treated for psorosis in this block of grove the bark-scraping method of treatment proved very effective.

During the 11-year period covered by the inspections and treatments a total of 13 trees, comprising 8 grapefruit, 1 mandarin and 4 orange, were added to the list of trees being treated in this block for gummosis and psorosis. The treatment of these began as follows: 1 in 1929, 2 in 1930, 2 in 1931, 1 in 1932, 1 in 1934, 3 in 1935, and 3 in 1937. The orange trees each had developed slight cases of psorosis in crotches of the main limbs, which appeared to be checked rapidly by the treatment, despite the disease developing later at new points on some of the trees. One tree, however, was removed in 1933 on account of decline from blight. The gummosis lesion which developed on the mandarin tree in 1931 required but the initial treatment to check it. The treatment also appeared to be quite effective in checking all but one case of gummosis developing on the grapefruit trees. Extensive cases of

TABLE III

SUMMARY OF 11 YEARS' TREATMENT OF 59 TANGERINE TREES FOR GUMMOSIS IN GROVE AT LOTUS ON MERRITT ISLAND, BEGINNING IN 1927

Year of Inspection and Retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	59	57	57	57	55	53	52	45	45	44
Trees not requiring treatment	0 or 0%	1 or 1.8%	10 or 17.5%	7 or 12.3%	8 or 14.5%	3 or 5.7%	2 or 3.8%	4 or 8.9%	10 or 22.2%	7 or 15.9%
Trees retreated because disease not checked by previous treatment	57	55	36	44	41	35	39	41	28	33
Trees retreated because of lesions developing at new points	0	1	11	4	4	14	4	0	6	3
Trees removed or discarded on account of decline from psorosis	0	0	0	0	1	0	0	0	0	0
Trees removed or discarded on account of decline from blight	2	0	0	2	1	1	7	0	1	1

typical psorosis were noted for the first time in 1937 on 2 grapefruit replants.

GROVE AT BONAVENTURE

In this grove of about 6 acres, 83 trees in which bark diseases were apparent were treated, beginning in 1927. The trees treated consisted of Florida Common grapefruit, Pineapple and Valencia oranges, and a single tree each of tangerine and Villa Franca lemon. Several trees at the west end of the grove were on sweet seedling orange stock while the remainder were on sour orange stock. The soil is Gainesville sand with some coquina limestone occurring within the root zone in places. The trees suffer from drought during more or less prolonged periods each year. Numerous trees were removed from this grove on account of decline from blight and bark diseases over a period of several years prior to 1927 and several trees have died each year since then. As a result, by the end of 1937, more than half of the original trees of moderate age were removed and replanted. Many of the trees originally treated in 1927 had bark diseases so far advanced that they soon proved hopeless.

Of the 83 trees originally treated for bark diseases, 8 were found to have an undescribed zonate canker working in the crotches of the divisions of the trunks and main limbs, particularly where old stubs were left in pruning. This was caused by an unidentified perennial, brown polypore (*Poria* sp.) which resulted in the decay of the interior wood of the attacked trunks and main limbs. The trees on which this was the principal trouble were eliminated when the results were tabulated at the conclusion of the treatments in 1937, thus leaving a balance of 75 trees, of which 38 were grapefruit and 35 orange.

Of the 38 grapefruit trees treated for psorosis, 29, all of which had fairly bad to bad cases when first treated, were either removed or discarded during the period as worthless on account of decline from this trouble. Within 4 years after the initial treatment, 20, or 69 per cent., of the trees having well advanced cases of psorosis to start with were either removed or had declined so fas as to be worthless. Three additional grapefruit trees were removed on account of decline from blight. Iu 2 grapefruit trees psorosis continued to show activity in 1937 and was not controlled. In the remaining 4 the disease appeared to be controlled at the final inspection in 1937. In 2 of these no activity of the disease was apparent for the last 8 years. Another showed no evidence of activity for the last 8 years except for a new outbreak in 1936. The fourth showed no evidence of activity for the last 7 years except for a new outbreak in 1935. The results of the treatments of the grapefruit trees in this grove for psorosis are summarized in Table IV.

Of the 35 orange trees treated for psorosis, 9, all of which had fairly bad cases to start with, were either removed or discarded as worthless because of decline from this trouble. Eleven additional trees were either removed or discarded on account of decline from blight. When first treated in 1927, the psorosis on practically all of these trees was limited to from 1 to 4 small lesions, all apparently being of recent origin. It is therefore quite likely that, had these trees not declined from blight, the psorosis could have been cured readily by the treatment, especially as there had been no evidence of activity of this trouble in some of these trees for periods ranging from 1 to 6 years prior to their removal or discard on account of decline from blight.

Definite failure to control psorosis occurred only in a single one of the 16 orange trees remaining in 1937, and on this the disease continued to show activity most years since the original treatment, including 1937. Only one other of these trees required retreatment in 1937 and this resulted from the disease starting at a new point after there being no evidence of activity for 7 years. In the other 14 orange trees some required retreatment because the disease was not checked by the first treatment, and several because of the disease breaking out subsquently at new points after it had been arrested in the lesions originally treated. Of these 14 orange trees, 2, 2, 1, 3, 3, 2, and 1 showed no evidence of psorosis for the last 3, 4, 5, 6, 7, 9, and 10 years, respectively, following the initial treatment in 1927. The results of the treatments of the orange trees in this grove for psorosis are summarized in Table V.

The gummosis on the single tangerine tree treated in this grove continued to show activity each year, either at the places originally treated

TABLE IV

RESULTS OF 11 YEARS' TREATMENT OF 38 GRAPEFRUIT TREES FOR PSOROSIS IN GROVE AT BONAVENTURE, BEGINNING IN 1927

Year of Inspection and Retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	38	36	28	20	18	17	15	11	10	9
Trees not requiring retreatment	10 or 26.3%	3 or 8.3%	8 or 28.6%	6 or 30.0%	8 or 44.4%	5 or 29.4%	7 or 46.6%	5 or 45.5%	4 or 40.0%	4 or 44.4%
Trees retreated because disease not checked by previous treatment	25	21	11	8	7	9	4	3	5	0
Trees retreated because of lesions developing at new points	1	4	1	4	2	1	0	2	0	2
Trees removed or discarded on account of decline from psorosis	2	8	8	2	1	0	3	1	1	3
Trees removed or discarded on account of decline from blight, etc.	0	0	0	0	0	2	1	0	0	0

TABLE V

SUMMARY OF 11 YEARS' TREATMENT OF 35 ORANGE TREES FOR PSOROSIS IN GROVE AT BONAVENTURE, BEGINNING IN 1927

Year of Inspection and Retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	35	35	30	27	22	22	22	21	21	18
Trees not requiring retreatment	19 or 54.3%	12 or 34.3%	13 or 43.3%	13 or 48.1%	19 or 86.4%	17 or 77.3%	17 or 77.3%	19 or 90.5%	16 or 76.2%	14 or 77.7%
Trees retreated because disease not checked by previous treatment	12	8	7	4	2	2	3	1	2	1
Trees retreated because of lesions developing at new points	4	10	7	5	1	3	1	1	0	1
Trees removed or discarded on account of decline from psorosis	0	4	1	2	0	0	0	0	1	1
Trees removed or discarded on account of decline from blight	0	1	2	3	0	0	1	0	2	1

or at new ones, until 1933, when it was discarded on account of decline from blight. The gummosis on the single lemon tree in this grove continued to show activity, either at old places treated or at new ones, almost every year, including 1937. While the treatment was absolutely ineffective in arresting the progress of the disease in this tree, the tree still continues to be productive.

During the 11-year period covered by the inspections and treatments 25 additional grapefruit and orange trees in this grove were added to the list of trees being treated for bark diseases. On 5 orange trees the trouble was merely zonate canker. The treatment of the balance of these trees for psorosis began as follows: 3 in 1928, 10 in 1929, 1 in 1930, 1 in 1931, 1 in 1935, and 2 in 1936. Of these 20 trees, 1 grapefruit and 1 orange were removed or discarded as worthless on account of decline from psorosis, and 2 grapefruit and 4 orange trees were removed or discarded on account of decline from blight. Of the remaining 12 trees, in 3 grapefruit and 1 orange the psorosis obviously was not controlled, while in 7 grapefruit and 1 orange tree there was no evidence of activity of the disease for periods ranging from 1 to 8 years. On some of the latter grapefruit trees the gumming appeared to be more typical of gummosis than psorosis. The results with these additional trees on which bark diseases developed since the initiation of the observations in 1927 clearly emphasize the fact that cases of psorosis and gummosis frequently can break out and develop with great rapidity in a very short time.

The bark-scraping method of treatment of the trees in this grove proved very effective, particularly on oranges, where the trees were treated before the disease made such headway as to become systemic and the interior wood of the trunks and main limbs became invaded by various organisms, after which the decline of the trees ensues rapidly. Much of the striking effect of the treatment was minimized, however, by the decline of a large number of trees from blight. The work in this grove shows clearly the utter futility of attempting to cure trees when the bark diseases have advanced to such a point that they are no longer amenable to treatment.

GROVE AT COCOA

In this grove all trees in which gummosis and psorosis were apparent in a block of 28 rows of 11 trees each were treated, beginning in 1928. This block consisted of mixed grapefruit, orange and tangerine trees of moderate bearing age on sour orange stock. The soil is St. Lucie fine sand, comprising white sand with a grayish surface layer. This type of land is extremely droughty and the trees have been observed to suffer seriously from lack of moisture during more or less prolonged periods almost every year. A considerable number of trees had been removed from this block on account of decline from blight and psorosis when the experiment was begun. This grove has been given fairly good care but the trees have been greatly handicapped because of the droughtiness of the soil and lack of fertility and organic matter.

Of the 22 grapefruit trees originally treated in this block of grove in 1928, 4 appeared to have but slight to moderate cases of gummosis. In most of these the disease was checked for a time by the treatments but in all cases it broke out again later at other points, particularly the callus formed around old partially healed pruning wounds. Three of these trees had been free of any gumming for the last 6, 2 and 4 years, respectively, of the experiment, but the last-mentioned tree developed blight and was removed in 1937. The other one had not shown any evidence of gumming during the years from 1933 to 1936 inclusive, but developed a slight gumming through two small cracks in the callus around an old pruning wound in 1937.

Of the remaining grapefruit trees the gumming exhibited appeared to be typical of psorosis. One of these trees apparently had but a slight case in 1928, whereas the balance all had moderately advanced to bad cases. In most instances the disease continued to be more or less active each year, but sometimes appeared inactive. Even though apparently checked where treated on the trunks and main limbs, the disease tended to break out above the treated areas, beyond where it occurred previously. In practically all cases it appeared to be systemic and gradually became worse each year, especially during those years in which the trees suffered from drought. In some in-

stances ,trees that were declining rapidly later improved temporarily, only to decline again later. Only one of these trees remained at the termination of the observations in 1937 and this appeared to be hopelessly involved. The others were removed or discarded as follows: 3 in 1929, 1 in 1930, 3 in 1931, 1 in 1932, 3 in 1933, 2 in 1934, 2 in 1935, and 2 in 1937.

Of the 20 orange trees originally treated in this block of grove in 1928, one rather small tree which exhibited an advanced case of psorosis, was discarded in 1932 on account of decline from this trouble. The remainder of the orange trees all exhibited from 1 to 3 small psorosis lesions on the trunks or limb crotches when treated in 1928. Of these, 5 in which the disease obviously was controlled were later removed on account of decline from blight. Of the remaining 14 orange trees, all but one appeared free of psorosis at the end of the experiment in 1937. Of these, 3 had not shown any evidence of the disease since the first treatment in 1928, and 2, 1, 5, 1, and 2 had not shown any evidence of the disease for the last 8, 7, 6, 3 and 2 years, respectively. In the case of the 2 trees that had not shown any evidence of psorosis during the last 2 years a slight new lesion, developed in 1935 in both instances, was the only evidence of the disease which these trees had shown since the original treatment in 1928. Thus the bark-scraping method of treatment appears to have been productive of excellent results on these orange trees which exhibited but early stage lesions of psorosis to begin with.

Of the 28 tangerine trees originally treated in this block of grove in 1928, many showed a reoccurrence of the trouble 3 years later in the first bark lesions treated. When the results of the treatments were sumarized at the conclusion of the experiment in 1937 it was found that in most instances these trees required retreatment nearly every year since the initial treatment. This was necessary either as a result of bark lesions developing at new points on the limbs or trunks, or small gumming spots developing in or adjoinjoining previously treated areas, or both. As a result of the frequent exposure of these trees to drought, several began declining and developed abnormally small, hard-looking foliage exhibiting more or less frenching. By the final inspection in 1937, 10 of these trees had been removed as a result of this decline. These were removed or discarded as follows: 3 in 1930, 1 in 1932, 1 in 1933, 1 in 1934, 1 in 1935, and 3 in 1937. Another of these trees was discarded in 1931 because the tangerine limb being treated was cut off. The remaining 17 of these tangerine trees all required more or less retreatment in 1937, either as a result of bark lesions reocurring in areas previously treated, or developing at new points or both. One of these trees was also observed to be declining at this time. In none of the 28 tangerine trees originally treated in this grove block, however, was the bark disease responsible for their death, nor did it appear to contribute particularly to their decline in any case.

It was of interest to note at the final inspection in 1937 that the bark disease in these tangerine trees probably was as active as it was in any year since the initial treatment was begun in 1928, and certainly much more so than it was in some years. The severity of this trouble the final year of the inspection may be due in part to the fact that it was not made until August 25. Had it been made prior to the active growing season of the trees, the disease undoubtedly would have made less headway since the retreatment of the previous year, as its greatest period of activity appears to be during the period of active growth of the trees. In any event, however, the results show that while the bark-scraping method of treatment readily checks the development of this disease in tangerine trees, the trouble invariably develops anew in later years at points remote from the originally treated areas and also in the treated areas after the lapse of 3 or more years, when the lesions appear to have healed completely. Since the disease develops so consistently at new places on the trunks and limbs where it was not apparent in previous inspections, it appears that the new outbreaks which frequently develop in previously treated areas are not a result of the disease holding over in these particular areas for a few years after they appear to be completely healed or of the disease being systemic. Like psorosis, this bark disease of tangerine trees frequently develops in crotches of the trunk or limb divisions.

During the 10-year period a total of 7 trees, comprising 4 grapefruit, 2 orange and 1 tangerine, was added to the list of trees being treated in this block of grove for bark diseases. Of the grapefruit trees, 2 that developed typical gummosis in 1931 were cured, while in one that developed psorosis in 1931 the tree appeared to be hopeless by 1935 but was still doing fairly well in 1937. Another grapefruit tree on which an extensive case of psorosis was first noted in 1935, improved greatly in 1936 but evidently declined later, as it was removed in 1937. In one orange tree which developed psorosis in 1931 the tree had lost two of its main limbs and was declining by 1937, while in another which developed psorosis in 1936 the disease was still quite active in 1937. In the single tangerine tree first treated in 1929, retreatment was required each succeeding year as the disease, though responding nicely at the places treated, kept breaking out at new points on the trunk and limbs each succeeding year.

DISCUSSION

The bark-scaling disease which has been so ommon on tangerine trees for many years in Florida is characterized by very little gum formation. Tangerine trees commonly have bad cases of this disease for several years without seriously affecting the life of the trees or curtailing crop production. This trouble, which was regarded by the writer some years ago as a form of psorosis, clearly is quite different from that trouble and will have to be regarded as a form of gummosis. Loal lesions yield with great readiness to the bark-scraping method of treatment but, unfortunately, new diseased areas keep developing at points on the trunks and limbs which are often quite remote from the areas previously treated. The disease also frequently begins to develop anew in previously treated areas where the bark appears to have become perfectly smooth and healthy, 3 or more years after their treatment. In view of the pronounced tendency for this bark disease to thus keep breaking out anew, the treatment must be repeated each year in many cases in order to keep the disease under control.

It is clearly apparent from the work of the past 11 years that outbreaks of gummosis and psorosis are inclined to be more severe in some years than in others. While it was not possible to correlate this definitely with seasonal or other conditions, it was evident that both these bark diseases make greater headway after periods of drought or other conditions which weaken the trees. Both these bark diseases are most active throughout the spring and summer months, which comprise the active growing period of the trees. They are least active and frequently make little or no advance during the brief winter period, when the growth of the trees is reduced to a minimum. Lesions of both gummosis and psorosis which sometimes show little or no activity for periods of several months may become active at some later period when conditions are more favorable for the development of these diseases.

The bark-scraping method of treatment has proved very effective in most cases in curing psorosis on orange trees and both gummosis and psorosis on grapefruit trees, provided the work be carefully and thoroughly done in the early stages of their development. By the time these bark diseases become systemic and areas of bark are killed to the wood and this becomes extensively invaded and discolored by various organisms, as reported by the writer* at the meeting of this Society 2 years ago, the treatment may possibly prolong the life of the trees somewhat but clearly is absolutely futile so far as saving the trees or affecting a cure is concerned. In not a single case has the writer succeeded in curing either an orange or a grapefruit tree where gummosis or psorosis has advanced to this point. In fact, in a few instances these diseases have progressed so rapidly that the bark-scraping method of treatment has not controlled them, even when attempted in what appeared to be a moderately early stage of the disease

Aside from the basal form designated as foot-rot, gummosis does not seem to occur on orange trees in Florida but is of widespread occurrence on both grapefruit and lemon trees. The latter are very susceptible to gummosis and they appear to be universally affected after they attain a few years of age. The disease often develops quite

*Rhoads, Arthur S. Some new aspects of gummosis and psorosis of citrus trees in Florida. Florida State Hort. Soc. Proc. 49 (1936): 36-49, 4 pl.; also in Citrus Industry 17 (10): 6-7, 15, 19, 23, 4 figs. Oct., 1936.

actively on certain trees in some years and appears much less serious on the same trees in others. While the trouble on lemons is quite difficult to cure, the trees frequently withstand it successfully for a good many years. On grapefruit trees gummosis often is more or less of a seasonal proposition. It frequently breaks out and develops with such great rapidity as to be quite alarming, often without any apparent reason, but later may cease activity and disappear without any special treatment, other than possibly some change in the fertilization or growing conditions. However, where areas of bark are killed down to the wood and the interior wood of the trunks and main limbs becomes invaded and discolored by various organisms the disease becomes systemic and the trees decline slowly but surely, despite treatment. Some of the gummosis on grapefruit trees in Florida is initiated by the common and well-known fungus, *Diplodia natalensis*. Most of it, however, appears to start from purely physiological cause and conditions unfavorable to the best growth of the trees. Once the bark is ruptured by gum forming in pockets between it and the wood the way is paved for infection of both the bark and the wood by various organisms, which naturally aggravate the trouble. Even where recovery does take place, if extensive areas of bark are killed the wood of the trunks and main limbs frequently decays rapidly, which results in materially shortening the life expectancy of the trees.

Psorosis, on the other hand, is a much more serious disease in Florida and the cause is not yet clearly understood. Fawcett has presented considerable evidence to show that this is a virus disease which is transmitted chiefly through the selection of budwood from trees having the disease, and which frequently may not break out on the bark until the trees attain an age of as much as 8 or 10 years. Despite the widespread distribution of psorosis in many of our Florida groves, however, there appears to be no particular tendency for this disease to spread to trees immediately adjacent to the diseased ones, since new cases appear to develop without regard to the location of these. Psorosis is quite distinctive on orange trees but on grapefruit may be confused readily with gummosis. Extensive investigations will be required on all these bark diseases before we can expect to have a definite knowledge of their respective causes and the conditions favoring their development.

THE WHITE FRINGED BEETLE A SERIOUS THREAT TO SOUTHERN AGRICULTURE

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You have been hearing much in the last few months about the ravages of the white fringed beetle in Walton and Okaloosa Counties and adjoining parts of Alabama and other sections in Mississippi and Louisiana, but I doubt if even now the farmers and growers of the peninsular part of the state really appreciate the seriousness of the menace. We have had no opportunity to observe the effect of this beetle on citrus, but we know that it readily attacks camphor and many other trees and that it is a very general feeder. Even if it should prove to be not a serious pest of citrus trees there is the threat not only to general farm crops, such as corn, peanuts, Irish potatoes and truck crops in general, but also to cover crops for citrus groves. Legumes seem to be the favorite food of these beetles. It feeds eagerly on beggarweed, velvet beans and crotalaria; not quite so eagerly on cowpeas. Although the adults do not feed on grasses the grubs do. Both adults and larvae attack even Mexican clover. If our citrus growers cannot even grow Mexican clover for a cover crop they will indeed be in a bad way.

The white fringed beetle is a worse pest of corn than the corn earworm and European borer combined. It is a worse pest of cotton than the boll weevil, a worse pest of potatoes than the Colorado potato beetle and a worse pest of sweet potatoes than the sweet potato root weevil. Besides these crops it attacks peanuts, sugarcane, and a hundred other plants. Hence in the aggregate it is a more serious threat to agriculture than all those we have mentioned combined, and we can throw in the Japanese beetle for good measure. The grubs do not even have to have living plant material for food. According to the workers of the Bureau of Entomology, they have been found feeding on decaying matter in the soil during the past winter, and even on a fence post. The asphalt roads and concrete foundations of houses seem to be about the only things that are safe from their attacks.

These beetles were first brought to our notice in Okaloosa and Walton Counties a little over two years ago. The grubs looked very much like those of the vegetable weevil and our first impression was that we had to do with that pest, but in July, 1936, we obtained the adults. We had never seen such a weevil and sent them to the National Museum in Washington, where they were identified as *Naupactus leucoloma* Boh., a South American insect hitherto unknown to occur in North America.

In the spring of last year the reports from the infested area became so alarming that we made three trips into the region to observe the behavior of the beetle and possibly to make recommendations for its control. On one of these trips we were accompanied by a man from the Cotton Department of the U. S. Bureau of Entomology and Plant Quarantine who, upon his return to Washington, interested the Bureau in this pest.

At the time of our first visit in May there were in many fields less than half a stand of cotton, even in fields which had been replanted twice. In whole acres of corn fields the corn was a total loss. The beetle was also ravaging peanuts, sugarcane, and in fact all crops grown in the section. It was very evident that in the heavily infested area agriculture as now practiced in the South would be unprofitable.

The grubs feed mostly on the underground portions of the stems of the plants and the roots. They ordinarily do not dig into the roots, but do so in the case of sugarcane, sweet potatoes and peanuts. On most plants they simply gnaw out great holes in the sides of the plants, and may girdle them. The first signs of their presence in a field will be wilting plants, which in a day or two may die. Scratching away the dirt from the base of these plants will reveal the dirty white, fat, footless grubs, from one to a half dozen or more per plant.

In late May or in June the majority of the grubs became full grown and pupated and about the middle of June the first adults were seen and they continued to emerge until August, reaching the peak of emergence about July 10. On heavily infested fields they were there in unbelievable numbers for an insect of its size—one-half inch. It was estimated that in some fields there were half a million per acre.

The food of the adults differs somewhat from that of the grubs. Peanuts, beggarweed, velvet beans, cotton, cocklebur, blackberries, Passion vines and Mexican clover seem to be favorites. None were seen feeding on grasses. They are not hearty eaters, but must eat for a few days before they will lay eggs. It is the grub that does the primary damage.

In the middle of a July day they are decidedly shade lovers, hiding under the upper leaves of a cotton plant, or down at the base of a peanut plant where there is more shade. They are all females. They breed parthenogenetically, as does the citrus aphis in Florida. This, of course, immensely increases the danger of their being carried into new sections, since a single female, or even a grub, carried into a new region can start an infestation. They have no functional wings and the only method of locomotion is crawling. Advantage is taken of this fact in combatting the pest. They are unable to crawl out of a trench with steep, crumbly sides, therefore the workers of the Bureau of Entomology and State Plant Board have surrounded the entire infested area with a ditch in which every rod or so is dug a post hole. Into these the adults fall and are killed every day or so by spraying them with oil or with a flame gun.

Unfortunately the work was not started early enough last season to prevent their laying an im-

mense number of eggs in the soil. With the energetic measures now being taken their numbers should be very materially reduced another year. The beetles are rather long lived, some of them living until December, according to the workers of the Bureau of Entomology and Plant Quarantine. They lay their eggs preferably on a clod or stick or stone resting on the surface of the soil, but in loose, sandy soil they will lay their eggs in the soil itself. The eggs hatch in the summer and fall and the insect spends the winter in the grub stage, often going to the depth of a foot or more in the soil.

As an illustration of what farmers in the infested region are up against, let me give the history of two fields in Walton County. In 1936 one field was planted to peanuts and according to the County Agent the crop was a total loss. When we visited this field in May of last year we found very few grubs in this field, but vast numbers in an adjoining corn field. In an area of six or seven acres adjoining the peanut field, not a single ear matured. In July these fields were again visited and there were very few beetles in the corn field, although the ground was peppered with their emergence holes, but the adjoining field, the same one destroyed in 1936, which had again been planted to peanuts was heavily infested. What happened was evidently this. The grubs had destroyed all the food plants in the corn field and the beetles had been obliged to migrate and had then infested the peanut field, in which they had laid millions of eggs. This year probably the history of 1936 will be repeated. If this field is planted to peanuts it will be an entire loss, but very few grubs will be found in the corn field.

This illustrates what the farmers will be up against in the infested area. If the infestation is not too heavy he might raise a crop on his land every other year, but in the alternate years planting a field to any spring crop will be a waste of time and money. This also gives a hint of a means of control. If all vegetation is destroyed in these fields in late June or early July, the adult beetles emerging from the soil will be obliged to migrate and if the field is surrounded by a ditch most of them can be caught and killed. This method is being adopted by the Bureau and Plant Boards of the infested states. A large acreage belonging to a lumber company has been turned over entirely to the Bureau, no attempt being made to rent out the land as usual.

The insect is a native of Argentina, Chili and Uruguay. It has been introduced into New South Wales, Australia, where it is said to feed only on alfalfa. Since its initial discovery in Walton and Okaloosa Counties and adjoining parts of Alabama it has been found in other sections of Alabama, Mississippi and Louisiana, in Pensacola and a single specimen taken near Thomasville, Georgia. There are very probably other infestations which have not been found. In Gulfport, Mississippi, there is another species of *Naupactus* which apparently has never been named.

The insect is not a pest in South America. In fact, nine out of ten entomologists in South America state that they do not know it. It is evidently held in check there by natural enemies. At the present time these are entirely unknown.

With the energetic measures now being taken by the Bureau of Entomology, aided by the Plant Boards of the infested states, it is hoped that the insect can be exterminated. This should not be any more difficult than the extermination of the Mediterranean fruit fly or the citrus canker.

THE CITRUS INDUSTRY IN RELATION TO GENERAL BUSINESS IN THE STATE

DEAN WALTER J. MATHERLY
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Mr. Chairman, Ladies and Gentlemen: I am to speak to you on "The Citrus Industry in Relation to General Business in the State." May I say, at the very outset, that I am not an expert on that industry. I do, however, feel that I know something about industries in general, consequently, I want to speak to you on industrial interrelationships. In doing so I want to make four (4) points or lay down four propositions which possibly may provide the background, the economic setting for this symposium on marketing.

The first point I want to make is that every industry is dependent upon every other industry. No producer exists unto himself, each is related to the other. What affects one industry affects another industry, what happens in one area happens in another area of the country. We are living in a nation which is bound together by visible and invisible economic ties and any producer to succeed in our economic system must understand those ties and how he is related to other producers and how his industry affects others and others affect his industry. The economy in which we live, move and have our being is an interdependent economy, it is an economy of specialists. We are divided up into various business units, industries producing this and that commodity; certain industries tie those together, everything is specialized. The United States Census Bureau lists 400 different classes of industries, each representing a specialty, each functioning in its own realm, the whole tied together by what we call economic organization, of society economy and economy of specialists, moreover an economy of geographic specialization. Each area of the country specializes in those products with which it is best fitted to produce, we are what we are largely because we are where we are. Florida engages in naval stores production, produces winter vegetables, grows citrus fruit and manages tourist hotels and other facilities not because it has any innate capacity to do these things successfully, but because we live in a physical environment where we cannot profitably do anything else. There is geographical specialization.

The South specializes in cotton, in tobacco, in vegetable production and citrus products, the West in wheat, corn and live stock businesses. The east central portion and northeast follow industrial pursuits, they devote time and interests to manufacturing, and the banks, the railroads, the insurance companies are organizations that tie these three economic areas together, and what affects the West affects the East, and what affects the East affects the West, and what affects the East or West affects the South, and what affects the South affects the East and West. There is geographical specialization. Why do we have specialization? It is a product of four or five factors. The reason industries develop is not accidental, they come because of the presence of one or more primary factors: (1) proximity to markets, (2) proximity to raw materials, (3) capital comes to where raw materials may be found. Five paper mills were established in the State of Florida in the past five years, and that is why we have paper mills in Florida, the proximity to raw materials. (4) The next factor is power. Power is highly significant. Industry goes to the place where it can get the cheapest and most abundant power. (5) Another factor is labor. In those industries where labor is important, they will locate in those areas where an abundance of labor, skilled or otherwise, exists, and, because of one or more of these factors, every region tends to specialize in production of those commodities it is best fitted to produce. No amount of exemption from taxes, no subsidy or granting of free lands will, of themselves, bring such an industry unless one or more of these factors are present. Industry would not come, and, if it does come for some other reasons and does not have these national factors backing it, it won't last long after it gets there.

The economic geographical specialization in which we live is international in character. Forces which may seem remote and of little consequence often become directly of immediate consequence.

Mass production depends upon mass consumption. A million delicate gears must mesh if food, clothes and shelter are to be forthcoming in this world in which we live. What affects the United States affects other nations and what affects other nations affects the United States. Let me give you one or two examples of how we function internationally. A few years ago a man out in Omaha invented the "Eskimo pie," I suppose you would call it an invention. Once he had placed that commodity on the market there was an immediate demand for it and manufacutrers thereof soon found it impossible to procure sufficient raw materials in the form of chocolate to meet the existing demand. They turned to Peru and began to increase their Peruvian importations of cacao. In the meantime an American sent a shipload of pianos to Peru, but they could not be unloaded because the importers did not have sufficient credits in the bank to pay for their unloading, but once the producers of raw chocolate began to ship more of that they built up their credits in New York and used them to pay for the pianos—the Peruvians exchanged cacao for pianos. Florida exchanges fruit and vegetables for machinery and other food and products produced in other areas of the world.

When women began to bob their hair a few years ago they ruined the New England cotton mill. That cotton mill was selling its products in northern China, where the natives secured their purchasing power by making hair nets and shipping them to the United States. When women began to bob their hair and lessened the demand for hair nets their market and purchasing power was cut off and the mill in New England ceased to sell its products in northern China. Here was a change in custom that affected nations as well as individuals and individual producers. The economy in which we live is an interdependent economy and a specialized economy, an economy of geographical specialization. Every industry is dependent upon every other industry. That is the first point I want to make.

The second point I want to make is that every industry is confronted with increased use of machinery. We are living today in the midst of a system of machine industry. Present day civilization differs from all previous civilization because of differences in methods of production of wealth and income. While all previous civilizations depended upon a system of hand industry, modern civilization depends upon a system of machine industry. In the past they depended upon the backs of men. Modern nations depend upon the backs of machines, iron and steel are substitutes for the backs of men. From the beginning of the Christian era—1400 A. D.—the economic world almost stood still, practically no improvements of any kind were made from 1400 to 1700, then man invented gun powder, the printing press, compass, and changed the entire situation of the world. More progress was made in the 300 years following than in the preceding 1300 years. About 1760 England witnessed an industrial revolution, then came the invention of machinery—five great inventions in a period of less than a quarter of a century—the spinning gin in 1776, spinning gram in 1769, the mule, a cross between the first two inventions, in 1779, the power loom in 1784, and the steam engine in 1785.

The appearance of these inventions produced a multitude of changes in economy of individuals as well as nations. England, and later the United States and other countries entered an era of industrialism, an era of great cities, an era of superfactories and skyscrapers, an era of interdependent national and international business enterprises. The age in which we live is an age of speed, airplane speed. Three or four years ago I visited The Hermitage, outside the city of Nashville, and saw there the carriage in which Andrew Jackson traveled in 1829 to the City of Washington to take the oath of office as President of the United States. It took him 30 days to make the trip. In 1830 it took six months to go from St. Louis to San Francisco by ox cart. In 1856 it took 21 days to go by stage, in 1860, 11 days to go by pony express, the fastest means of transportion then known. In 1869 it took seven days for the first continental train from New York to go to San Francisco, and in 1932 they flew from Los Angeles to New York in 10 hours. In 1933 they

took five minutes off that, in January, 1937, they made it in seven hours, 16 minutes. Whereas, it took the first man to navigate the globe and sail around the world three years, Wiley Post flew around it in less than eight days. Not long ago a little speed plane made 404 miles an hour. I, myself, flew in a Brazilian clipper from San Juan, Porto Rico, to Miami in eight hours, going 150 miles an hour. We are certainly living in an age of machine speed and airplane speed. Someone aptly said, "You must run like hell to stay where you are."

The result of this machine age is the increased speed in American civilization. We have transferred to the machine our thought and our skill. The machine today has the skill of a human being, the brain of a human being, no individual can add as accurately as an adding machine, nor can do a score of things as accurately as a machine can do them. We have transferred both thought and skill to the machine. We have a machine at the University of Florida put out by an international business concern that scores examination papers. College professors no longer have to read them. Students are given a special type of graphite pencil to do the work and that machine will pick up the right answers and the student can't fool the machine, they have tried it and failed.

The machine industry today characterizes American civilization, we have transferred to it thought and skill and increasingly the machine is displaying our skill and is doing our thinking. By the use of machinery we have increased our power of production, we have secured control of national forces, mechanical rather than muscular forces. We have increased our speed and regularity of production, the machine does not get tired, the machine has delicacy of touch, it has certainty of action, it has fineness of operation, it does not struggle over contests between the A. F. of L. and the C. I. O., it does not have to be bonded by a bonding company, it does not have any feeling—as long as you give it some oil and put the power to it, it is accurate. It has speed, certainty of operation, delicacy of touch far superior to anything human beings have been able to display. By the use of machines we increase the quantity of production of what we have for consumption.

In the prosperous twenties the national output increased 46%, but the number of workers only 16%. In 1921 I visited the factory where they make Chesterfield cigarettes. I saw a machine cutting off 500 cigarettes per minute. I am told it has been perfected today where it cuts off 2500 per minute. It would require one billion people, that is, half of the estimated population of the earth, to weave by hand what 1,500,000 persons weave with the use of a modern power loom.

In 1787, at the beginning of our Republic, 19 persons were necessary to support one person in town; today 19 persons can support 56 persons in town and from five to 10 persons in foreign countries. In 1800 one skilled worker made 30 pins a day, in 1900, even 37 or 38 years ago, one workman produced 500 pins a day. The machine is being constructed to do almost anything. Only a few days ago I read a description of the use of the machine in Czechoslovakia for filing. Here was a great business enterprise constructed with files that went to the ceiling and the clerk had a small desk and chair that moved horizontally or vertically from file to file, a perfectly huge filing room that needed about one or two persons to operate it all.

The replacement of men by machines is destined to continue. Unemployment caused by displacing men with machines is here and here to stay. It will increase rather than diminish, there is no circumventing the machine. The automobile industry in 1930 even could produce or required only about one-third as many workers to produce a given number of cars as it required in 1914. In 1920 there was a ticket taker on each subway platform in the city of New York. Today there is not a ticket taker anywhere. There is a machine into which you deposit your nickel, and that machine does not have to be bonded, does not get tired, does not enter into strikes and is more accurate than any human being. The day of complete automaticity of manufacture is bound to come—when I do not know. We will still need engineers and skilled mechanics to control and care for the machines, but we are increasingly going to have automatic manufacturing processes and it is coming in agriculture as well as manufacturing. It is coming in the household as well as in the school room. Every industry is con-

fronted with increased use of machinery, that is the second point I want to make.

The third point is that every industry is concerned with increased corporate ownership and management. The biggest single fact in our political and economical system today is the machine, the second biggest fact in our political and economical system is the corporations. If we are to understand that system we will understand it in proportion to our understanding of the machine and of the corporation. The development of ownership of wealth passed through first individual proprietorship, partnership and now corporations. Everything of importance that is carried on in America is increasingly being carried on by corporations.

The average size known banking corporations today have gross assets of $570,000.00 and an income of $22,000.00. The American Telpehone and Telegraph Company is eight thousand times the size of that average corporation and the United States Steel Corporation is 4,000 times the size of that average corporation. There are 200 corporations in the United States today which have assets each of more than one hundred million dollars; 15 of these have assets of one billion dollars or more; the 200 corporations together own eighty-one billion dollars' worth of assets or approximately 50% of the corporate known banking wealth of the United States. Of those 200 corporations 42 had railroads, 52 had public utilities and 106 industrial or manufacturing concerns; 300 other known banking corporations own the other 50% of the known banking wealth of the United States.

Secretary Wallace has estimated that by 1950, at the present rate of growth, these 200 corporations will own 70% of the known banking corporate wealth of this country. Those large corporations are growing 2½ times faster than the average size corporation. With the growth of such corporations, ownership and management have been separated. Those who are stockholders are scattered all over the United States. Those who are managers do not even own a controlling interest. The American Telephone and Telegraph Company brags about the fact that no stockholder owns as muct as 1% of its stock. Consequently the corporation has brought about concentration of increased economic power into the hands of a few and those few are not the majority owners. Through the use of the proxy and pyramiding and other corporate devices, some of which are perfectly legal and some of which at least are not illegal since not attacked by law as yet, they have been able to concentrate the control of those corporations in their hands and not even the majority of stockholders share. So much for corporations increasingly functioning in our economic life, increasingly furnishing us the goods and services which you and I consume, increasingly touching us in everything that we do; every industry today is confronted with increased corporate ownership and management and the corporation has invaded agriculture; increasingly it will become the dominant form of organization in agriculture. It employs 90% of the workers in manufacturing, in transportation and accommodation, and in mining. Increasingly we will get our products from large corporations and increasingly the mass of the people will work for large corporations.

What I am doing is analyzing, not criticising, not as a reformer, but as an economist. To shut our eyes to the problems of the corporation and increased economic control in the corporation is to blindly approach the problem which confronts us, as citizens and businessmen. My third point then is that every industry is concerned with increased corporate organization and management.

The fourth and final point which I want to make is that every industry has to do with increased government control, whether you like it or not. Again I am not criticising, but analyzing, speaking as an economist and not as a reformer, as a citizen and not a politician. Demand in government arises when social friction develops. It develops when we cease to be pioneers and unite. The present requires more government than the past, and the future will require more government than the present. The principal purpose of government is to protect the many against the few, to safeguard the interests of the 98% who obey the law against the encroachments of the 2% who disobey the law. To enable the mass of citizens to secure their greatest social or community good with the expenditure of the least social or community energy. Originally the rights of the in-

dividual, including the business man, were considered supreme. The cry was not for less government in business, but for no government at all in business. Individual rights were to be surrendered only when the common good of the whole demanded it, and government regulation was unjustifiable and undesirable. The system of philosophy our forefathers believed in was to let government keep their hands off.

Such was the economic system of the nation when there was no large cities, no big manufacturing plants, people were scattered along the Atlantic Seaboard. There you have the background out of which that philosophy developed, but, as those people moved up rivers and across the Piedmont to the Appalachian mountains and spilled over into the Mississippi valley and then on to the Rockies and over to the Pacific Ocean or the Pacific coast, and began to develop national resources, build railroads, construct steampship lines, establish great corporations, increasingly it became necessary for the government to step in and safeguard the interests of the whole from the interests of the few.

So, prior to 1932 we already had government regulations in many forms. There was regulation of public utilities, provisions for which had been made by the Interstate Commerce Act of 1887 and numerous amendments of that Act down to 1932; regulation of insurance companies by State laws, regulation of banks and money in credit through the provisions made by National Banking Act of 1863, Federal Reserve Act of 1913 and all amendments to these Acts; there was regulation of marketing and brokerage agencies, provisions for which had been made by the National Warehouse Act of 1916, the Packers and Stockers Act of 1920 and the 1922 Grain Act. Regulations have existed, beginning in 1890 and passing down through the years with amendments, the Federal Trade Commission Act of 1914, 1932, but prior to 1932 pressure from this was negative rather than positive, the government was never a major-domo in the household of business; but since 1932 increased government control of private enterprises has appeared on many fronts. Why did it appear? Did it happen accidentally? Nothing ever happens accidentally, there are three primary causes, first the breakdown of competition, competition as envisaged by our forefathers back at the close of the 18th century did not regulate the Pikes Peaks of prosperity and Death Valleys of depression, overbuilding of economic facilities with overproduction, overextension of credit, the collapse of purchasing power, breakdown of the monetary system, supply and demand did not operate, as in simpler days of this country individual man could not do anything about it. Moreover, the depression which came in 1929 was a depression that was more severe, more unstable and deeper than any depression in the history of our country. Illustrating by pig iron production in the depression beginning in 1873 it dropped from the peak of prosperity to the bottom of depression 23%; in 1893 it dropped 28%; in 1927 it dropped 35%; in 1932 it dropped 55%; in 1929 it dropped 80%.

What has happened to the pig iron production may be illustrated by other industries. Due to this fact people demanded increased government control and it came.

The second cause is the result of the dislocation caused by the World War. From 1914 to 1918 our economic system was greatly speeded up. I believe some forty million new acres of land were brought into cultivation in order to feed the allies; our manufacturing system speeded up to provide munitions for our allies and later for ourselves and that threw our economic system in high gear and during prosperous twenties we found it difficult to readjust ourselves. Moreover, dislocation abroad disturbed capital abroad and the capital flowed into this country and we had money to burn. Furthermore, import quotas abroad, export bounties, tariffs and depreciated currencies further cut down their buying power in this country and cut off goods we were shipping abroad and the result was America was all dressed up economically and didn't have anywhere to go. Consequently this brought hard times and depression and the people demanded the government do something.

The third cause is that in the early years of depression we let business pull its own chestnuts out of the fire. It was argued that business got us there, let it get us out. Government did call together business leaders and suggested and helped along certain programs and relieved the credit

situation, but did not force any correlative acts. In 1932 Hoover reaffirmed his views and Roosevelt came out for the "New Deal" and the people went to the polls and spoke and elected Roosevelt. In the hectic days of '33 he did something, in '34, '35 and since many laws were passed providing for increased government control and here we have increased government control today in agricultural, manufacturing and scores of other industries. There are three points at which government controls business today—first, control not suppression of the deleterious effects of competition and an attempt to balance demand and supply; second, control of capitalization so as to assure a fair and reasonable return on capital investments through control of bank credit, guarantee of bank deposits and supervision of the issuance and sale of securities; third, control over the economic security residing in Social Security Act. Within limits, American business is still free. Anyone can enter or go out of any business he wants to except public utilities and those are licensed under police regulation.

Business may be tied, but not head and foot, rather tethered. The open range of business is closed, it looks as if it is closed forever. No longer it seems to me will individual profit seekers be allowed to roam at will. Many of our conservative citizens and many of those even less conservative are alarmed at or are frightened over the increased centralization of power and control over private business enterprises. The effectiveness of democracy today is challenged seriously, challenged on many fronts. On the left there is Communism as represented by the dictatorship of Joseph Stalin; on the right there is Fascisticism as represented by Benito Mussolini and the dictatorship of Adolph Hitler. In the center stands democracy trembling. Will democracy be crushed between the upper millstone of Fascisitcism and the lower millstone of Communism, will it be able to withstand the pressure both from the right and from the left? While the answer in Europe is uncertain, the answer in America is, I think, certain. We will not sell our Democracy, our Democratic Birthright, for a mess of European pottage. (Loud applause.)

We will not give up the liberties, the civil liberties, the political liberties for which our forefathers fought and which we have inherited for two reasons—first, because we still have a strong middle class of property owner citizens; second, we are beginning to develop in this country a sense of humor, something which we have needed to develop during the past half century. The New Yorker magazine said not long ago, "the contest in Europe is spreading to the United States, but here it takes the form of a contest between the insiders and the leftouters." I think that is the view of most people. While we have already modified our system of government and will continue to modify and adjust, we will not scrap it, nor will we exchange it for the Italian, German, or Russian system of government.

As an economical background, or economical setting for the Symposium which is to follow, I have attempted to lay down four propositions. May I, in closing, pass them in review: *First*, that every industry is dependent upon every other industry; *Second*, every industry is confronted with increased use of machinery; *Third*, every industry is concerned with the increased corporate ownership and management, and, *Fourth*, every industry has to do with increased public control of private enterprise.

If these suggestions are valid and if they are worth anything, accept them; if not, cast them aside. (Applause.)

Mr. Brooks: Thank you, Dean Matherly. That was a masterly speech.

Our next paper is entitled "The Grower's Interest in Marketing, by Chas H. Walker of Bartow. Mr. Walker.

THE GROWER'S INTEREST IN MARKETING

CHAS. H. WALKER
Bartow

About all that the average Florida citrus grower knows about marketing is how he sells his own crop and how much he gets for it. He has no idea what happens to his fruit after it leaves his grove, or what determines the price he receives.

I say this after having tried for thirty years to interest growers in their marketing problem. The number who really understand anything about it is pitiably small. And yet, today, the most important problem of Florida growers is how to sell their fruit at a profitable price.

There was a time when the chief worries of the grower were those of production—how to cultivate, how to fertilize, and how to control grove insects and diseases. The Experimental Stations, with the cooperation of the growers, have solved the production problems. The grower did not have to give much thought to marketing because someone usually came along with an offer to buy their fruit at prices that showed a profit to the grower. Now, the grower must likewise cooperate with other agencies for the marketing of their fruit.

Nowadays few of us have difficulty in raising a crop of fruit, but when we produce it we find that we cannot always sell it—at least for its real worth. As production problems have become simpler, those of marketing have become greater. And with the production of citrus fruits continuing to increase it looks as if marketing problems will become more serious than any we have had before.

If you, as a grower, have not had sufficient interest in marketing to take the time and trouble to find out what's wrong with our present system of selling fruit, it's high time you gave it some study. Mark my words, unless something is done and done soon to improve marketing conditions, all of us may soon be on government relief. As a matter of fact, we're partly on government relief right now! What else can you call the government's purchase of oranges which we can't sell?

Here's an industry doing a business of about $50,000,000.00 a year which we growers own lock, stock and barrel. It shoud pay us a fair profit for our labor and investment. It should be a simpler matter for us to get together and make it pay, but instead we do nothing and more or less trust to luck that we can sell our fruit each season for enough to buy the fertilizer and grits and gravy.

All of the people who have anything to do with our fruit from the time it leaves our groves until it reaches the consumer are organized to protect their interests. The fertilizer manufacturer doesn't sell us fertilizer for less than what it costs. The packers charge everything it costs them to handle our fruit. The railroads recently got a raise in freight rates to help them. The auctions, the wholesalers and the retail stores are organized and all get their profit when they handle Florida fruit.

Everybody's organized but we growers! Is it any wonder that there's nothing left for us after all of the others get theirs? The consumer still pays enough for our fruit to return us growers a fair price for it. But there are too many deducts between the consumer and the grower. Instead of taking what's left, we growers should organize and put a price on our product. It can be done and it must be done if fruit production is to be made profitable again.

There are several ways that Florida growers can organize and regulate the sale of their fruit. I am not advocating any one method today. It is not so important *how* we get together as it is that we *do so* in some way. Federal laws exempt us from anti-trust restrictions so we can combine and fix prices for our fruit. There's not another class of business in the country which can legally do that—and yet every other business would if it could! Other Federal laws provide ways in which we can regulate the distribution of our fruit. I say again—it matters not how we control our fruit prices just so long as we do it.

Don't forget what a job it was to sell all of our grapefruit produced in Florida and Texas last year, and how low prices were during most of the season. This season we've been up against the same thing with oranges, due to the record crops in both Florida and California. And next season—well, you have seen the bloom. It now looks as if the new crops of both oranges and grapefruit, in California and Texas as well as Florida, will be much larger than anything we have seen before.

Organized we can sell next season's crops at a profit, even though they are larger. I've discussed the problems of Florida growers with executives of large chain store systems. These fellows helped us sell all of our grapefruit last year, and they've greatly increased the consumption of oranges for us this year. They tell me they would be glad to pay enough for fruit to return the grower a fair profit if we in Florida will just fix the price so their competitors can't buy it for less. They even tell me they can sell *more* fruit for us if prices are stabilized.

No one will ever do this job for us. If the marketing of our fruit is to be regulated we've got to do it ourselves. I have been encouraged by the interest which growers in some parts of the state have taken in marketing problems during the past year. I hope that this interest will continue to develop and make possible some organized effort next season to give back to the growers the control of their industry.

Chairman: Thank you for your address, Mr. Walker. Our next speaker is Mr. L. P. Kirkland.

Mr. Howard Phillips here claimed the floor to introduce a motion as follows:

Mr. Howard Phillips: Mr. Chairman, Friends: Two years ago I appeared before the Florida State Horticultural Society and told them at that time my observations of the two bushel box, which was then introduced, and issued a warning that sooner or later the Florida growers would regret the introduction of such a packing box in spite of the many advantages claimed for it. Only too well in the last two years have my words about this package become true. Today, we are selling generally two bushels of fruit for exactly the same price that we are selling 1 3/5 bushels. The meager saving that might be effected in packing house operations by the use of the two bushel box is nothing in comparison to the loss we sustain by giving away this extra amount of fruit.

Now, if the consumers were getting the benefit, we might excuse the use of this box and say eventually by lowering prices we will get increased consumption, but that is not the case.

Two years ago I asked this Society to take some action concerning this two bushel box, but nothing was done because little was known about it. Today I don't believe there is a grower or a shipper present who does not full well know the effect of the two bushel box on our marketing of citrus fruit. We are today, in our 1 3/5 standard box, giving more than California, in our two bushel box we are giving 2/5 more even than we were before and California is outselling us in all of the markets. This has affected every single grower of oranges and grapefruit in the State and I think it is high time now that this Society take definite action and immediate action.

Thankfully our Florida Citrus Commission has taken due notice of this menace and has, to the best of its ability, stemmed the tide. It has gone on record as opposing the use of the two bushel box and has issued an order forbidding its use. At the moment the Federal Courts have restrained the Commission from carrying out this order and, whatever the results of this Federal Court hearing, this Society, I think, should commend the Florida Citrus Commission for its stand and urge legislation at the next session of the Florida Legislature forbidding once and for all the use of a container larger than our standard 1 3/5 bushel box.

If we are to have government interference of business, let us get some benefit of that regulation. I therefore offer to this Society, and pray that I may have a second and immediate action on this motion:

"I move you that the Florida State Horticultural Society by rising vote commend the Florida Citrus Commission for its efforts to remove from interstate commerce citrus packages of greater than 1 3/5 bushels cubical contents; that the Florida State Horticultural Society through its Secretary communicate such action to the Florida

Citrus Commission; that copy of this motion be sent to the Hon. Fred Cone, Governor of the State of Florida, that copies of this motion be sent to the members of the Citrus Committee of both houses of the State Legislature at the next meeting of that body and furthermore that the Florida State Horticultural Society urge the passage of a law or laws which would specifically forbid the use of citrus containers larger than 1 3/5 bushels capacity except in movement from the field to processing plant."

Motion was seconded by J. W. Sample and unanimously carried.

The Chairman suggested the matter be referred to the Legislative Committee to which Mr. Phillips acquiesced as long as the committee takes due notice of the action of the Society from the floor.

MARKETING AND PRODUCTION

L. P. KIRKLAND
Auburndale

The production of citrus fruits in Florida, Texas, Arizona and California is increasing very rapidly. In all probability the crop for 1938-39 will be much larger than the crop for the season now closing. You all know what the results have been in Florida this season.

Is the present system of marketing bringing satisfactory results for the growers? I believe that the answer would be unanimously: No! The lack of team work in the industry has been very expensive. The growing of citrus fruits is of too much importance to the state and nation for any of us to give up the fight to put this industry on a profitable basis.

You may now ask what is necessary to correct some of the practices that are hurting the industry. First, there are 331 packing units in the state with a capacity of packing 1,476 cars of grapefruit per day or 995 cars of oranges per day and this does not allow for any overtime. This means that approximately 8,400 cars per week can be packed for shipment. We have packing facilities sufficient for putting on the market a crop of thirty-six million boxes in approximately seventy-five working days and no one working overtime to do it. There are approximately 250 sales units. The burden of trying to carry all of these packing, shipping and sales units is greater than the grower can live under. In my opinion in the absence of control of the movement of fruit there will never be another profitable year for the citrus growers of this state.

Now for the production: A few days ago right here in Winter Haven I was discussing production and quality with a grower who has two or three hundred acres of grove and he passed off the question of quality fruit with the remark that he sold his fruit on the tree and that the shippers who bought fruit demanded nothing in the way of quality, but wanted to buy at the powest possible price. I know with prices as they now are there is every temptation to grow fruit as cheaply as possible and in too many cases with no regard for quality. I have eaten fruit from many groves in the last few years that the program of fertilization particularly has been such that the flavor and texture of fruit has been completely destroyed. I am convinced under present conditions that quality fruit should be the motto of every grower, and unless it is, the final results are going to be disastrous. In my opinion if we in Florida will grow the quality fruit that we can grow and set up the proper control of shipments we can get a fair profit from our investment in groves.

It has been demonstrated by both Texas and California, who have control organizations, that you can certainly get a higher return for your fruit. The records show that in the first five weeks Texas was under proration they moved to market 3,235 cars of grapefruit and the price per box advanced from $1.83 to $2.28, a gain of 45 cents per box, and that for the same period Florida with no control shipped 2,692 cars, or 543

cars less than Texas and we had a decline in price from $1.75 per box to $1.81, or a decline of four cents per box. You all know that California oranges for weeks sold from 75 cents to $1.00 a box more than our oranges and you can give control of shipments full credit for this difference.

Are we going to use the brains and intelligence God has given us to better these conditions, or will we continue to be selfish and wreck this industry? If every grower and shipper will get behind a real, progressive merchandising and advertising program, and a constructive marketing agreement and not let politics interfere with it (though there is grave danger of that happening), and ship nothing but the very best fruit, with all of us working to better the industry as a whole instead of our own individual positions in the industry, we will see the industry move forward very rapidly. With Texas, Arizona and California working under control and Florida with no control of any kind we are definitely headed for ruin and disaster, unless we put our house in order.

NEW THOUGHTS IN MARKETING

JAMES C. MORTON
Auburndale

In 1877, the first carlot shipment of California oranges moved from a grove in the vicinity of Los Angeles to St. Louis. By 1885, shipments had increased to a thousand cars. In October of that year, because of "disastrous prices obtained," the Orange Growers Protective Union of Southern California was formed "to regulate the shipment of citrus fruit and distribute the same in such manner as to prevent overstocking of markets and thereby prevent such competition among the stockholders or their fruits as is prejudicial to their interests."

The topic assigned to me is "New Thoughts in Citrus Marketing," but that fifty-three-year-old California declaration of purpose shall be my theme, and to throw new light on its application to today's conditions in Florida, my aim.

Be it very definitely understood by all, that anything that I say is but the expression of my own, personal, opinion, and is not a reflection of the opinion of those with whom I am associated at Waverly, many of whom would, no doubt, differ with me as much as I expect the majority of you to do, and my purpose is to make my presentation of the subject as brief as possible in order that there may be ample time for those of you, who so desire, to express yourselves freely.

No general plan or single item of marketing procedure can be developed for Florida citrus fruit without carefully considering the varied avenues by which the Florida citrus grower chooses to send his fruit to market. Three groups of growers appear prominently in any discussion of marketing methods.

1. The grower who sells his fruit on the tree to the speculative buyer, who is frequently used by the industry as a scapegoat upon which to lay the blame for its many sins of omission and commission. The speculative buyer can only exist as long as there are speculative growers.

2. The grower who ships and sells his fruit independently, receiving the price it brought in the market less fixed charges for services rendered, or receiving an agreed percentage of the net returns.

3. The grower who packs and markets his own fruit, either as an individual or in cooperation with other growers, sharing equally the burdens and benefits.

Each one of these three major groups of growers must have a reasonably equitable position in any broad proposal that affects marketing.

Large plantings here and in other areas, the progressive maturing of trees and improved scientific feeding and cultural methods, have created unprecedented and ever increasing volumes of fruit for which a profitable market can be found

only through wider areas, and extended periods of distribution or greater per capita consumption, or both.

Wider distribution is handicapped, first, by increasing costs of transportation, second, by diminishing returns as we cross the boundaries of marketing areas which are within more economical distribution range of other citrus-producing sections, third, by lack of tariff barriers to importation of Asiatic tangerines, fourth, by limitation of export opportunity through increasing foreign production of both oranges and grapefruit.

Per capita consumption is diversely affected: by national pay roll, total volume of citrus fruit nationally produced, volume and consequent market price of competing fruit crops, reputation honestly won or deservedly lost because of quality, or its absence, in the product shipped.

The citrus industry is extremely fortunate in, and has been largely dependent for its success in the past on the increased consumption created by the health value of citrus fruit, so long and loudly proclaimed by both physicians and dentists, and every effort must be made by producers to carry the story of the medical profession into every home.

Wider distribution and increased consumption are being practically and profitably stimulated through the advertising funds created under State law, my only objection to which is that the amount expended, particularly on oranges, is too small to adequately do the job. However, the benefits of advertising will never be fully gained as long as the industry asininely permits fruit individually-stamped "Frozen Culls" to be shipped at all. This season, these went as far north as New England. Neither should the industry continue to ship the major portion of its volume in containers incapable of carrying it to market in reasonably sound condition.

To our detriment and disgrace, the axiom of yesterday, "Every doubtful orange is a cull," has been changed to "Every doubtful cull is a merchantable orange."

Many federal panaceas for agricultural problems have been attempted in the past decade and all, so far, have lacked success because of their failure to recognize man's insurmountable inability to accurately control agricultural supply to meet market demand.

The Agricultural Marketing Act of 1929 created the well-financed Federal Farm Board. One-half billion dollars to stabilize markets for agriculture! Its purpose was to stimulate the organization of national cooperatives, to be fortified with credit at low interest rates, through which they might carry redundant supplies over a period of excess production or limited demand in order to await the return of a more favorable supply-and-demand condition. During the scant four years of the Board's existence, a preponderant part of its activities was devoted to the field of marketing, of which—despite ample financial and legal power—it made an outstanding failure.

The Federal Farm Board's third annual report, issued in December, 1932, contained the following comment:

"Experience with stabilization has demonstrated that no measure for improving the price of farm products, other than increasing the demand of consumers, can be effective over a period of years unless it provides a more definite control of production than has been achieved so far."

Perhaps the recent farm control enactment was conceived in this statement and given birth by the present administration's desire to boost the profits of agriculture and so, now, we have in many of the staple farm products federal dictation as to the number of acres that the individual farmer may plant, this in an effort to reduce production to within the limits of profitable demand. This effort to upset natural laws, like the Federal Farm Board program, I believe is doomed to failure.

In December of 1924, Mr. George N. Peek, who, since 1922, had been the chief proponent of a plan for bringing about improvement for agriculture, gave as his belief that there is no way to control or regulate production, and there would be no relief in it if this were possible, a general advisory role being all that should be attempted. In 1924, writing as president of the American Council of Agriculture to President Coolidge's Agricultural Conference, Mr. Peek said:

"It is unfortunate that many spokesmen for agriculture accept the view that the farmers' troubles come from overproduction * * *. The existence of an exportable surplus of a vitally im-

portant food crop or commodity is not an evil, nor should the aim be to render it non-existent by acreage reduction * * *. No human power can adjust acreage in crop or number of livestock so as to be certain of having no surplus for export on the one hand, without inviting national underproduction, possibly famine, on the other * * *. No human agency can adjust acreage or number of these great commodities and, except by accident, arrive at, or anywhere near, the desired mark in production. No human agency should attempt to. The one attempting it would be faced with the necessity of suggesting substitute crops to utilize the acres thus vacated. The difficulty of this is apparent. It is noteworthy that those ardent advocates who in 1923 would have turned the wheat farmers into commercial producers of butterfat, are now silent in the face of existing conditions in the dairy industry. Even if it were possible for farmers through voluntary organization to make a nice adjustment of acreage to the estimated domestic demand, there is no possible way of forecasting to what extent drouth and flood, hail and freeze, insects and disease—all these and others beyond the farmers' power to forecast and control—would thwart such calculations."

On May 12, 1933, the Agricultural Adjustment Act passed by Congress was approved, its effort being to stabilize marketing conditions through the adjustment of shipments to market demands in an anticipated better return to growers. The citrus industry of Florida, Texas and California immediately sought to take advantage of this Act and marketing agreements became effective in both Florida and California on December 14, 1933, and were followed by the license which became effective on December 19th.

I need not further recite the series of marketing agreements and attempted marketing agreements which have followed, but say very definitely that after four years of intensive effort on the part of the best minds of the industry, we are forced to conclude that no marketing agreement can be written that will fit the peculiar conditions that exist in Florida. Discarding fancies and facing facts, my humble, but very definite, decision is that equity to the three groups of growers mentioned or provision for its assured continuation cannot be expressed in the cold, clear language required by law. It isn't possible to write any marketing agreement in the necessary legal phraseology to make it stand the strain of court attacks and at the same time be fair to all types of producers and shippers. No marketing agreement can be written with mathematical exactitude that will meet all conditions and variations, geographical, varietal and seasonal, that arise in Florida. So, I am fully convinced that further time spent in an attempt to develop another Florida Marketing Agreement is time futilely wasted, as long as conditions exist in Florida as they now are. Neither am I convinced, as many seem to be, that a marketing agreement will be found a panacea for all our problems.

Presuming that we had in Florida the power to control volume and raise market values, what would be the result? It becomes increasingly apparent that, when any group has the power to control the price of the commodity it produces and sells, the tendency is to raise the price too high, the result of which is that high prices tend (1) to retard consumption and, (2) to increase production, both of which lead to the failure of the purposes for which the control was instituted. Again, if, through adequate control the price of our product is made higher in its relationship to competing products, then, too, consumption is immediately retarded and the purpose of the control again defeated. These dangers exist in voluntary programs and must be watched, but they can be made disastrous under marketing agreements and licenses because the degree of control is greater.

Experience under the Agricultural Adjustment Act is too brief to appraise the results which will follow if the system is continued, and informed persons state that price enhancement resulting from the Cling Peach Agreement resulted in the unwholesome effect of planting peach trees. Under a marketing agreement, asparagus planting threatened to be overdone until prices of competing groups sharply checked asparagus acreage. The favorable prices for Florida celery obtained in the 1934-1935 season were not due to marketing agreement so much as to a year when competition of other celery-producing areas was very low and the plight of the celery grower today clearly shows that his problem has not and, I believe, cannot be solved by federal control.

Orderly distribution has its value, but can never overcome the price-depressing effects of large volume fighting for a place in a market handicapped by low purchasing power, and those who earnestly believe that a marketing agreement will, in some miraculous manner, add fifty cents to the value of every box of fruit shipped, are headed for the mire of disappointment in pursuit of a will-o'-the wisp as dangerous as that that lured the farmer during the existence of the Federal Farm Board.

Now I do not mean to imply that the Florida industry could not be greatly benefited by a more orderly distribution of its fruit, both as to time and place, because the value of this has been demonstrated, but a successful program of this character cannot be written in a federal marketing agreement—as has been proved in the last five years. Such a program must grow out of cooperation within the industry, itself.

In 1928, at a growers' meeting held during the Orange Festival in Winter Haven, this same problem was up for discussion and a group of earnest growers were instructed to give the matter study and find its solution. These men worked earnestly and at a meeting of this Horticultural Society, held in this city, their plan was first presented. The plan was put into operation the following season and very speedily demonstrated its elasticity to meet all Florida's requirements, its practical value in methodically aiding the distribution problem, its cooperative value in creating harmony and cooperation within the industry. That plan—I don't care from what angle you view the problem—is still the only solution to Florida's growing distribution question.

Our problems will never be solved by schoolboy economists who know nothing of them, but will only meet practical solution by hard work, earnest effort and enthusiastic willingness to cooperate on the part of the industry, itself. I am not at all eager to see the citrus industry of Florida do as other agricultural groups have done, Esau-like, sell their birthright of liberty and independence for a mess of federal pottage. Florida's solution lies, not in Washington, but in the hands of you men who produce our citrus crop and who have the capacity and courage to meet its problems, or invite the aid of those who *can*. The need of the Florida citrus industry is not menacing and questionable federal control, but sincere cooperation within the industry, itself.

Please keep this firmly in mind: a number of consecutive prosperous years would ruin our industry. Spells of low prices are a necessary, valuable and really profitable restraint on every agricultural and industrial pursuit. Any easy, assured, abundant annual income from citrus production would speedily destroy itself because in a few years every available citrus acre in the four producing states would be planted out. Quit whining. Men and nations thrive on hard knocks and, remember, Florida growers must learn (perhaps through bitter experience) to subordinate individual interest to common good. The key word is *Cooperation.*

Such cooperation existed and successfully operated following the establishment of the Clearing House in 1928 and it would be difficult to estimate the tremendous amount of good that accrued to Florida citrus growers through the weekly gatherings, frank discussion and exchange of information among those who were engaged in marketing. Informed analysis and exchange of opinion on market trends and the various factors that affect price expectation and market demand, together with study of market values and the probabilities of their rise or fall, all had a wholesome, enlightening effect that was profitable in dollars and cents.

Florida's greatest marketing need today is, cooperation. We need the weekly discussion of those very pertinent points of sales and distribution policy, together with the steady, confidential exchange of price information and the regular dissemination of all factual and statistical data having a bearing upon citrus market values. True, such voluntary acquiescence to a general plan had its difficulties and serious problems, but these were small when compared to the almost insuperable handicaps that may emanate from a not-improbable future federal control of every citrus grove.

COMMENTS ON CITRUS MARKETING

W. H. MOUSER
Orlando

Mr. President, Ladies and Gentlemen: I started to write a paper to read to you today, but I have been busy walking through groves and cutting fruit, so I came down simply to talk for a few minutes and if what I say is rambling you will understand that I am talking without notes or any paper to read.

The biggest step ever made in Florida in connection with marketing of our citrus fruit was the passage of the law providing for advertising We talk about merchandising and merchandising is bound up very tightly with advertising. You can't merchandise without advertising. A few shippers did a small amount of consumer advertising, but not a drop in the bucket to what was needed. I happened to be connected with the sales department of the California Fruit Exchange at one time. First we tried out consumer advertising, spending $25,000.00 in the state of Iowa, and this was such a success we continued.

Our first thought in advertising was to induce the consumer to eat or drink more oranges. Our second thought, after they were sold on the idea of using more oranges, was to get them to use California oranges and next, to get them to use "Sunkist."

Now I believe the time has come when Florida, as a grower of grapefruit particularly, can get away from one of the things that has been a handicap in our advertising to the consumer. We have been only able to use local radio spots or radio in certain sections and local papers. Now I believe we have reached the stage in production of grapefruit in this country where the problem to the Florida grower, the Texas grower, the Arizona and California grower is to get people to eat more grapefruit. I suggested two years ago our getting together with Texas, California, and Arizona in a national campaign of advertising The subject has been brought up in Texas, and I see no reason why grapefruit of all the producing states could not be assessed to create a national fund. I do not mean 75 or 150 thousand dollars, I mean a real fund put into a national campaign over radio hookup with big stars and performers that do the same things to the average consumer they do to you and me—make us want to hear them—tell about grapefruit, why they eat it and to eat more.

The Florida grower is a manufacturer. The trees are your factory. You manufacture two competing articles, oranges and grapefruit, the tangerine does not compete from the same extent. When you get out an orange advertisement that party is sold on oranges and he doesn't eat grapefruit. When you get grapefruit advertisements before the public they become sold on grapefruit and eat those. So you are manufacturing two competing articles. If someone would give me half a million dollars and a reasonable tonic recipe I will be able to, with that half a million dollars and a good advertising agency, make people like that tonic or think they should use it, especially if it has a good taste, and if not, give me enough money for advertising and I will make them think they need it. Take your grapefruit and advertise it as the Nation's tonic, you shouldn't go to bed at night until you have consumed a large glass of grapefruit juice which, while you sleep, creates an alkaline condition and, ladies, it is a great beautifier for your complexions, men, it gives you more pep and vigor, for the next day. All those kind of things, see. Also teach them to follow Doctor Phillips' idea. I wrote the Commission last summer offering some suggestions about things we can do in advertising, but we have got to spend money. I have been in business since 1900, when I was 18 years old, eight years in California and the rest of the time in Florida. You people are manufacturers of citrus fruit.

Now, one other thought, I want to defend the Florida citrus industry. Mr. Morton referred to a California clipping dated some fifty or more years ago. I had a clipping, I don't know where it is now, from the Jacksonville Times-Union, dated in the '90's, which said, "The only thing the

matter with the Florida citrus industry was distribution and marketing." Now, I have a little granddaughter, and I may have some more, and I make a prophecy, when my granddaughter is grown they still will be attending meetings and listening to these same things, especially following a low price year. The season 1924-25 was a red ink year. I was invited to make a talk before the Winter Haven Chamber of Commerce and if I could find the manuscript I could make the same talk today. It is the same story since 1900, when I was a boy. The thing moves in cycles, notwithstanding low price of this or that year. God loves his children. He does, but not any more the children in Florida than he does the apple and celery people. How can we expect high prices for fruit with everything else selling low? Where would the automobile manufacturers be if, instead of cutting down to three days a week, instead of seven full days of work and overtime at night, they pushed production, where would they be? Our plant is the trees. Nature causes them to work overtime, not only here, but in Texas and California.. For the past six weeks the movement of oranges has been 50% more than a year ago.

I am for improvement, we should be on our toes, but in doing it let's not get up in public and fill our papers full of stuff to the fact that our industry is no good. I call on anyone to show any industry in the country, horticulture, agriculture or otherwise that in a five-year average will pay growers more than the producing of citrus fruit will.

Two or three weeks ago I noticed a letter in the Tampa Tribune reading: "Dear Editor, I have a friend who owns a citrus grove in Polk County. He has been telling me he cannot sell his fruit and does not know what he is going to do. In talking to another friend from the North I found he wanted to buy a grove, so I got him to write to this friend and he offered him $700.00 an acre for the grove with two-thirds cash. The man with the grove wrote back, 'Why, I would be foolish to take that price when in five years' average production I get five million dollars.' I wonder if citrus growers don't just like to talk?"

God put thorns on rose bushes, also beautiful roses. That is life. I'll tell another little story. Johnnie's father was a sheep herder and the school teacher gave Johnnie this problem: There were ten sheep in a field and two jumped over the fence. How many remained in the field. None, teacher, said Johnnie. You're wrong, said the teacher, and she proceeded to draw a picture on the board, showing the field and ten little dots for sheep. Then she erased two, and said, You see, Johnnie, there were eight sheep left in the field. Johnnie spoke up and said, Teacher, you may know arithmetic, but you sure don't know sheep.

The point I make is simply this: There may be so many packing houses that pack so many cars a day, but they just don't do it. One bank could perhaps conduct all the banking business in your town, but things aren't meant to be that way. You can draw diagrams of this, that and the other, but they don't always work out, and I don't believe they are meant to work out. So let's work for improvements in our industry and continue on our toes and keep it up to date and meet changing conditions, but in doing so let's say we have got the best industry in the United States or the world. It is fine on any five-year average, it is a dandy thing, but we are going to make it better. Let's not vilify or run down our industry or use the club of fear to bring growers along certain lines of thought. (Hearty applause.)

SYMPTOMATOLOGY OF DEFICIENCIES AND TOXICITIES OF CITRUS

DR. A. F. CAMP
Citrus Experiment Station
Lake Alfred

The ability to recognize the symptoms of deficiencies and toxicities as they present themselves in citrus trees has become of prime importance in the fertilization and handling of groves. Our soils work has not yet reached the point where we can definitely correlate soils analyses with tree condition even when such soil analyses are made in the laboratory under closely supervised conditions. Even after such correlations are established it will be necessary to develop accurate quick methods adapted to our soils before such tests can be put into actual commercial use. On the other hand, the citrus tree itself has been found a very accurate indicator of nutritional conditions and the symptoms indicative of certain deficiencies have been found very specific as well as extremely sensitive. The symptoms of four deficiencies in citrus have now been worked out in a fairly complete way and will be presented in detail in this paper together with the symptoms of one toxicity which has frequently been mistaken for a deficiency of some sort. The four deficiencies discussed will be those of zinc, copper, manganese and magnesium and the toxicity will be that of boron.

It should be pointed out perhaps that no attempt will be made to go into the realm of conjecture concerning other deficiencies that may exist but for which the exact symptoms have not been determined. Various types of plants have widely different mineral requirements. Crotalaria, for instance, will grow luxuriantly on a soil so deficient in zinc that tung trees will hardly grow at all; thus, a soil that might be deficient in some element in terms of a certain crop may contain adequate for another. Moreover, symptoms of certain specific deficiencies vary widely in different crops; thus, typical "frenching" is due to zinc deficiency in citrus, but equally typical frenching in tung trees is caused by manganese deficiency; so that it may not be concluded that because citrus shows a certain symptom which resembles the symptom of a deficiency in cotton, that this same deficiency actually exists. The subsequent descriptions will, therefore, be limited to those symptoms which have been carefully worked out on citrus. Any discussion as to the reasons for their occurrence will have to be omitted for the present owing to lack of time.

In this paper the term deficiency will be used in connection with such things as Frenching and Dieback, i. e., *zinc deficiency* and *copper deficiency*. While it may be argued that this may not prove to be technically correct, such terminology has the distinct advantage of tying up the name with the element used as a corrective. Moreover, the fact that there is a particular derangement that responds only to the application of a certain element and that this application can be made to the tree instead of the soil, would tend to substantiate the idea that it is a deficiency. The fact that the process involved is complicated and indirect would not vitiate the correctness of the term.

ZINC DEFICIENCY OR FRENCHING

As far as possible this description will be limited to the symptoms per se and the manifestations present when other deficiencies modify the symptoms will be omitted.

Foliage Symptoms: Frenching as observed in Florida has characteristic leaf symptoms which can be easily recognized. It is characterized by green areas along the midrib and the main lateral veins, the remaining areas being light yellow to almost white. The relative amounts of green and yellow tissue vary from a condition of mild frenching in which there are only small yellow splotches between the green veins to a condition in which only a portion of the midrib toward the base of the leaf is green and the remainder of the leaf light yellow to almost white. In immature leaves some of the smaller veins may be green

and present a lacework of green on a light yellow background. As the leaves mature the small veins may lose their green color, but small green spots 2 or 3 mm. in diameter may persist. In the milder cases the leaves are almost normal in size, while in severe cases the leaves are small and abnormally narrow, having not over a tenth of the area of normal leaves. The tendency to produce unusually narrow pointed leaves is one of the very distinct symptoms of frenching.

Growth Symptoms: In mild cases, frenching may appear on occasional weak twigs, the rest of the tree remaining green, or it may be general over the tree with little reduction in leaf size. In the latter case the growth is likely to tend to an unusual erectness in contrast to the usual spreading growth. When more severe, frenching occurs over the entire periphery of the tree. The growth is shortened and this combined with the short narrow leaves gives the tree a peculiar brushy appearance and this is accentuated by the development of numerous adventitious shoots. All the twigs are weak and die off quickly so that there is always an excess of dead wood in the tree. In contrast to the persistent dying back over the periphery of the tree there is a vigorous development of watersprouts on the large limbs and trunk. These watersprouts are commonly free of frenching and give the tree a dense center of growth in contrast to the weak, dying appearance of the outer portions of the tree. Such trees may decrease in size very rapidly due to the dying back of the twigs.

Fruit Symptoms: The fruit borne on weak twigs carrying small frenched leaves is unusually small, the rind very smooth and the color, when ripe, is unusually light. The pulp of such fruits is woody with a very low juice content. In contrast to the fruit borne on the frenched twigs is the large coarse fruit on the watersprouts. In severe cases the production is mostly culls which are either very large or very small, and very little good fruit is produced.

Distribution: Frenching is more common on oranges than on grapefruit and least common on tangerines, though all may be affected. The seedy varieties of oranges, such as Pineapples, are usually more severely affected than Valencias, while it is still less common on Parson Browns and other early oranges, and thus may be related to crop strain. Seedling trees are seldom as severely affected as budded trees, but on occasion may suffer seriously. Generally speaking, frenching is commonest in Pineapple oranges, but can be found in any varitey of citrus.

Modifications of Frenching: The above description applies primarily to frenching uncomplicated by other deficiencies. In such cases a zinc spray applied during the spring will cause the frenched leaves to green up rapidly and this will be followed by a flush of growth with normal leaves and characteristics. The small frenched leaves do not grow appreciably after they have become green, but continue on the tree, giving a peculiar mixture of foliage. In contrast to the above there are many cases complicated by other factors such as magnesium or copper deficiency. Unfortunately such combinations of deficiencies are more common than a straight zinc deficiency and such cases do not respond satisfactorily unless all the needed elements are supplied. Frenching was long considered a symptom of dieback, copper deficiency, because it is almost always associated with dieback. This sort of situation is not strange since factors that tend to produce a deficiency of zinc are likely to also eliminate or tie up such elements as manganese, copper and magnesium.

COPPER DEFICIENCY OR DIEBACK AND AMMONIATION
(Exanthema of Fawcett)

Dieback and its associated ammoniation is confused with frenching only through persistent association of the two troubles. When separated from frenching the symptoms are distinct as will be noted from the following description. B. F. Floyd has described dieback in detail so only the main points will be mentioned here.

Foliage: The foliage in the earlier stages is unusually dark green, the leaves are large and thick and unusually vigorous, which is the first symptom looked for. On the severely affected twigs which will be mentioned later, a few small weak leaves may develop and shed, but these are only on twigs in the process of dying.

Growth: One of the first growth symptoms looked for is the appearance of "S"-shaped, soft over-vigorous twigs. These combined with the dark green foliage mentioned above are taken as

definite first indication of dieback. As the trouble progresses gum pockets appear between the bark and the wood, and an unusual excretion of gum will take place at any break or cut. Severely affected twigs will show excrescences of gum near the terminal end and such twigs usually lose their leaves and die back for some distance. As the case progresses the tree will show a body of dark green, heavy growth with a great many dead terminal twigs. Multiple buds are numerous so that a great many twigs develop and many of these die. The bushy growth of small twigs frequently considered symptomatic of dieback are primarily associated with zinc deficiency rather than copper deficiency.

Fruit: The manifestations of copper deficiency on the fruit have long been termed "ammoniation." The young fruit is light green in color disfigured by light brown markings, or excrescences which darken as time progresses and may become black by the time the fruit is half grown. Severely affected fruits are likely to drop while less than 1½ to 2 inches in diameter, splitting is common and a considerable percentage of the splitting will be across the axis. Gum pockets are common in the rind and around the seeds of ammoniated fruit. Less severely affected fruits will be large and coarse, with large dark markings and frequently gum around the seeds. In severe cases, no fruit of first or second grades will be produced, but a scattering of ammoniated fruits is commonly the forerunner of severe dieback and a truer indicator of copper deficiency than twig or leaf symptoms for zinc and magnesium deficiencies, and may be so severe as to restrain the vigorous growth of twigs and leaves so that the commonly recognized foliage and growth symptoms never appear.

Distribution: The use of copper sulfate for the correction of this trouble has been known for many years and this combined with the general use of bordeaux has kept copper deficiency at a minimum, but there is evidence to indicate that it would be general throughout the citrus growing area if it were not for the use of copper. It is generally worse on oranges than on grapefruit or tangerines.

MAGNESIUM DEFICIENCY OR BRONZING

The term bronzing or copper leaf is rather more loosely applied than the terms frenching and dieback and is used to designate a type of chlorosis which is very common throughout the citrus belt. It has been particularly severe during the last several years on the lighter sands and has caused a very considerable reduction in the bearing capacity of trees. The symptoms described here are limited to those apparently caused by a deficiency of magnesium, although it is common to find the symptoms of severe manganese deficiency included. The narrower limitation seems more desirable since the broader use of the term is likely to cause misunderstanding.

Foliage: Bronzed leaves do not show the pattern of green veination which is characteristic of frenching, but do show in the later stages an over-all cadmium yellow to bronze cast. This may start as two elongated patches, one on each side of the midrib, and spread outward to the periphery of the leaf until only a green midrib is left and the green along the midrib may gradually fade until it is only a wedge-shaped area at the base of the leaf which remains green. In some cases the entire leaf takes on an over-all yellow to bronze cast and no green at all is apparent. Leaves when affected with this trouble never show the narrowing that is characteristic of frenched leaves and normally are all full size, having developed first as normally-appearing green leaves and later becoming bronzed in contrast to leaves on zinc deficient trees which are frenched from the beginning. In severe cases the leaves may be slightly reduced in size and this is particularly characteristic of the type in which the leaf is entirely yellow.

Bronzing usually appears in the late summer or early fall on heavily fruited trees and particularly on limbs carrying a cluster of fruit, whereas light fruited trees or limbs that are not carrying fruit will remain green. When the trouble is severe and a large proportion of the leaves is affected, there will be a heavy leaf fall and a consequent heavy reduction in the effective leaf surface of the trees. Such trees do not respond to fertilizer treatment satisfactorily and while the leaf characteristic may be and probably is associated with

crop strain, it cannot be restrained through application of nitrogeous fertilizer.

Growth: Trees affected primarily with bronzing do not take on the bushy appearance of trees affected either with dieback or frenching. They retain their naturally spreading shape, but considerable dead wood appears and frequently large limbs will die out and have to be removed so that the trees in severe cases become progressively thinner both as to foliage and growth so as to become almost skeletonized. The profuse development of watersprouts characteristic of both dieback and frenching does not take place and the tree has a hard, weak appearance.

Fruit: In the early stages of bronzing, trees usually bear heavily, but as the trouble progresses the production is reduced due to the reduction in bearing surface and also due to the production of large quantities of small sizes. Other than that the fruit seems to have a normal quality and fair texture until the advanced stages are reached and the tree is almost dead, at which time the production may drop to almost nothing. In mild cases of bronzing production may be maintained at a high level for several years and the fruit have a reasonably good quality. In such groves the trees seem to recover during the spring and early summer and bronzing appears in the fall and the trees become progressively weaker until the crop is removed, at which time the trees start to green up again. This may be considered a marginal case which may suddenly develop into a very severe form with a heavy loss of wood.

Distribution: Bronzing is generally much worse on grapefruit than on oranges or tangerines, and is particularly associated with seediness in grapefruit. Marsh Seedless very seldom shows a great amount of bronzing and the same is true of the Thompson Pink, which is a seedless pink sport of Marsh. It appears to a considerable extent on oranges, however, and seems to be worse on Pineapple and probably next on Valencias, thus being associated with both seediness and late maturity and the consequent crop strain that results. Early varieties such as Parson Brown and Hamlin do not show as much of this, but on occasion may show severe cases. It is not very pronounced on tangerines, but occasional cases occur. It is very common to find it associated with frenching and where copper sprays have not been used for disease control or for corrective purposes, dieback may also appear, but not in its characteristic form due to the restrained growth.

MANGANESE DEFICIENCY

Manganese has been used extensively on citrus on calcareous soils for what is known as marl chlorosis or marl frenching. Its use on acid soils as well as marl soils has been recommended by Bahrt and considerable work has been done by Bahrt and his associates along these lines with excellent results. The symptoms have not been thoroughly described, however, probably due to the fact that they commonly occur associated with frenching and it is only since the work on zinc has reached an extended scale that manganese deficiency symptoms have been accurately separated from frenching. The symptoms as given below will be incomplete because of the fact that the work on this phase of symptomatology has not been completed at the present time.

Foliage: Leaves showing manganese deficiency take on much the same pattern as is present in frenching with a green midrib and green lateral veins. The tissue between the veins, however, does not take on a yellow color, but remains a light green so that there is a dark green pattern of midrib and veins with a background of lighter green. In mild cases it may resolve itself into a series of light green patches along the periphery of the leaf between the lateral veins. On the immature leaf this pattern will be fairly bright and quite easily observed, but as the leaves mature they take on a peculiar dull slate cast and unless the investigator is looking closely, the pattern may be overlooked. This dull slate cast seems to be rather definitely associated with manganese deficiency not only in citrus but in other plants and makes the leaves extremely difficult to photograph. On the marl soils the pattern is usually more pronounced and the leaves as they mature take on a grayish to slate cast. This peculiar symptom is probably due to a combination of zinc and manganese deficiency with the latter being predominant, but with the more pronounced zinc deficiency covering it up to a certain extent. The use of manganese for more characteristic types of frenching was common a number of years ago,

but experiments in the last few years by the author have indicated that the characteristics of frenching occurring on these soils do not respond to manganese treatment but to zinc. Both on the marl soils and on the acid sands, frenching if present in abundance will almost completely mask manganese deficiency and it will only be observed after zinc has been applied. The leaves do not take on the characteristic shape that is associated with frenching and will only have a pronounced pattern when they are quite young. The trouble seems to be associated primarily with growth conditions and appears to the greatest extent on trees that are in vigorous growing condition.

Growth: No characteristic growth symptoms have been observed to date, but Bahrt and the author have observed an improvement in tree condition and a general improvement in growth following manganese treatments on deficient soils.

Fruit: No definite fruit symptoms have been associated by the author with manganese deficiency, but Bahrt reports increased intensity of color following applications of manganese and has reported this to be particularly noticeable in tangerines. He has also reported the fruit is firmer and better able to withstand shipping. Some chemical relationships have also been established and the readers are referred to Bahrt's paper on this subject.

Distribution: The symptoms of manganese deficiency have been found general throughout the citrus belt during the last year both on acid sands and on the alkaline soils along the coast. They have been much more pronounced on grapefruit, tangerines and Temple oranges than they have on round oranges. They have been found almost universally on tangerines except in those groves where manganese has been used either alone or in the fertilizer. Where frenching or dieback or both are present in profusion, or where bronzing is severe, only an occasional typical leaf may be found, but when such groves are treated so as to eliminate the other deficiencies, manganese deficiency will show up in abundance. The observations in connection with this work have indicated that frenching probably occurs under practically the same soil conditions as manganese deficiency, but due to its more pronounced pattern and also to its effect on growth, masks the symptoms of manganese deficiency. Where frenching is severe, characteristic manganese deficiency can seldom be found, but commonly appears as soon as zinc is applied. Particular attention is called at this time to manganese deficiency because of the fact that many growers have noticed it and have merely considered it partially corrected frenching instead of a distinct deficiency.

BORON TOXICITY

Coincidental with the increased use of borax and other boron compounds in packing houses, there has been occurring in groves a peculiar chlorotic condition which has been found to be due to excessive applications of borax or other boron compounds to the soil. This has been brought about mainly through two practices: first, the dumping of culls in the grove and the careless inclusion of fruit that has been dipped in borax and not thoroughly washed afterward, and seconally, the leaving of boxes which have been treated with borax in the field for extended periods so that the rain may wash the borax off the boxes onto the ground around the trees. It has also occurred to a considerable extent around packing houses where borax has been extensively used and the borax tanks are allowed to drain near adjacent citrus trees. In some cases where the entire box of fruit including the box is dipped in borax solution and the boxes after removal of the fruit have been stacked on a platform, the rain has often washed enough borax from the boxes to kill all the citrus trees and other vegetables near the box platform. The grower who finds this trouble in his grove and who is unfamiliar with it commonly associates it with frenching because there is a certain amount of resemblance between the two troubles. For this reason the symptoms of boron toxicity will be given below.

Foliage: Following application of an excessive amount of a boron compound to a tree, the leaves will begin to show a yellowing near the tip followed by a splotchy yellow coloration along the peripheral portions of the leaf. The yellow color will increase in intensity to become a dark bronze color. Semicircular areas of dead tissue will occur around the edges of the leaf or the entire tip of the leaf may be killed. These leaves shed at

the junction between the petiole and the leaf, and in severe cases the trees may become quickly defoliated. Almost immediately such trees will put out a succeeding flush of growth in which the leaves will be almost white with a narrow green midrib. This stage and the succeeding stages are quite commonly mistaken for frenching, but the characteristic narrowing of the leaf is not present and in fact as the flushes progress in severe cases, the leaves become smaller and rounder than normal. The severely affected leaves mentioned above will shed quite early and successive flushes will follow and where the rains are plentiful or where irrigation water has been used to wash the borax out of the soil, they will gradually begin to recover with the leaves showing less of the yellow condition and more green. The yellow color occurs nearer the tip of the leaf and does not have the characteristic light yellow to white of frenching, but soon takes on a deep yellow which is very distinct. In the early stages the leaves may show a large number of small yellow dots scattered over the surface of the leaf and these are particularly noticeable on the under side of the leaf and near the tip. The leaves also have a peculiar characteristic leathery texture which is distinct from the ordinary smooth, hard texture of citrus leaves and this symptom combined with the coloration makes it very easy to identify the trouble and to separate it from frenching.

Trees that have received an unusually large amount of borax will continue to put out flushes of growth for some time with the leaves becoming gradually smaller and rounder and showing a great many dead spots around the edges and the trees may become almost defoliated. In milder cases a gradual recovery is made as the borax is leached from the soil and the leaves become very large and thick and the pattern disappears.

Growth: In severe cases of boron damage there will be a considerable loss of wood throughout the tree and in extremely severe cases the tree may be entirely killed. Usually, however, a certain amount of dead wood develops and the tree starts on a process of recovery with the loss of wood never being very pronounced.

Fruit: Severely affected trees usually lose their fruit quickly and do not put on succeeding crops of any size until recovery is practically complete.

Distribution: Grapefruit trees have been found to be unusually susceptible to boron damage and most of the cases observed have been on grapefruit, although a few severe cases have been found on other varieties as well. In experiments it has been found that it takes considerably smaller quantities of borax to produce severe symptoms on grapefruit than is the case with other varieties. The trouble is usually limited to small areas in the groves where boraxed culls have been dumped or where loads of boxes carrying borax on them have been left through a rainy period. It is seldom found evenly distributed over a grove and may only affect two or three trees here and there where either truckloads of culls or piles of boxes have been left. The only treatment that has been found of value is an application of irrigation water if available or to wait for the rains to leach it out of the soil. If the trouble is not too severe this will usually occur within twelve months. The commonest place to find this trouble is around packing houses where borax is used extensively for fruit treatment. Treatment with lime is sometimes helpful, but the damage has usually been done before the trouble is noted so that applications are too late to be of great value.

Other deficiencies and toxicities will undoubtedly be worked out from time to time, but speculation concerning these is idle except as a guide to research. It is almost certainly true that as the deficiencies above are supplied, the chances of identifying others become greater as is evidenced by the fact that the use of zinc has made the identification of manganese deficiency easier. It is possible, too, that as the work develops, soil tests may become increasingly useful, but at the present time the tree itself is the best indicator of its needs.

GROVE CONDITIONS AND PRACTICES IN RELATION TO THE MATURITY OF CITRUS FRUITS

HARRY L. ASKEW
Lakeland

The subject assigned to me for discussion, "Grove Conditions and Practices in Relation to the Maturity of Citrus Fruits," is one which has been of special interest to citrus growers and shippers since the enactment of our first citrus green fruit laws a number of years ago.

I well remember the outspoken opposition to the first chemical maturity tests for citrus fruit and the apparent willingness and desire on the part of a large number of our high class growers and shippers to evade this law. It was really a sport and a popular pastime and the growers and shippers who were the most flagrant violators were not only *not* condemned, but rather praised and considered smart and a number of our large and high class operators at that time would boast of the large volume of fruit they had shipped early which would not pass the maturity tests, and these same high class operaeors were vain to the extent that they considered such practices as evidence of their superior ability and shrewdness, for at that time the green fruit laws were unpopular even with a number of our honest and high class operators. This condition prevailed for some time, but each year the game of evasion became more and more unpopular as both growers and shippers began to realize the future benefits to be derived from such laws, and finally the situation completely reversed itself and those same high class operators are now among the most enthusiastic boosters for our maturity laws and are the first to condemn any attempt at evasion. I realize that even now we do each season have a certain amount of violations, but I am fully convinced that the day of applauding the violators and calling them smart has passed and public sentiment is definitely in favor of our maturity laws.

The 1934 freeze which came in early December as did the extreme cold weather of this season has created a desire on the part of all growers to move their fruit as early as possible each year and when we remember the fact that so many growers lost their entire crops in 1934 and again in 1937 this desire for the early shipping of fruit which has almost developed into a mania cannot be criticized nor condemned, for when our extreme cold in years past came in January and February, there was not the urgent rush to move fruit so early as now exists and if each of us will place ourselves in the shoes of those growers who lost their entire crops in 1934 and again in 1937 and both years in early December, we cannot but feel that this early shipping mania is at least partially justified, therefore, one of the thoughts uppermost in the minds of a number of our growers is how can I handle my groves so my fruit will mature and pass the maturity test before there is any danger of cold. We realize that if all of the early and mid-season oranges in the State should pass the maturity test in November it would be impossible to move them all each season before there was any danger from cold, so it seems that we will, of necessity, be forced to assume certain cold risks, regardless of the desire of every grower to move his fruit in November.

The use of arsenic on grapefruit has made it possible for practically all of the seeded as well as seedless varieties to pass the acid test early, therefore, if we have an early bloom and sufficient moisture to produce the juice requirements, we are all on an equal basis and are able to ship early more palatable grapefruit than the markets will consume at that time.

I have, for years, been an advocate of the use of arsenic on grapefruit, realizing that the sensible spraying with arsenic did no more harm to the trees than our regular sprays of oil, blue stone, zinc, copper and lime and sulphur, but as all of you who have been connected with the industry for as long as 12 to 15 years will recall, there was about that time a very efficient campaign conducted through the State against the use of arsenic and those well meaning, strictly honest opponents suc-

ceeded in arousing public sentiment to the point where the Legislature passed a law forbidding the use of arsenic. I was at that time rather disgusted and peeved, for I realized that we were giving Texas a decided advantage. It required several years for the industry to realize that a mistake had been made which had cost the State of Florida thousands of dollars, and you will probably recall that a few grapefruit growers brought a suit in Polk County before the Honorable Judge Petteway, who ruled the arsenic law as affecting grapefruit was unconstitutional and his decision stands today with reference to grapefruit alone and many of those well meaning leaders who were instrumental in having the arsenic laws passed are today as strong advocates of its use on grapefruit as those of us who continued the fight for its use and were responsible for the Polk County suit. I think that now since the industry as a whole knows how to use arsenic on grapefruit, we have probably made more progress because of the law and the publicity it gave. I have used arsenic on grapefruit for the past fifteen years. I did not discover its effect on citrus, but began experimenting with it after learning of its action or reaction and I am thoroughly convinced beyond a shadow of a doubt that it is a great blessing for Florida grapefruit growers if used intelligently, for those of us who have watched closely know that a lot of our grapefruit will not pass the acid tests even in February unless sprayed, and grapefruit arsenated in the early Spring will hold until May or June, and instead of becoming insipid really holds its flavor much better than fruit which has not been treated; so any fear that this practice might cause an insipid flavor of grapefruit, late in the season, is unfounded and has been proven to be an erroneous suspicion. To those growers, who have never used arsenic, but intend to do so, this season, I would recommend not to use to exceed one pound of arsenic to the one hundred gallons of water, if you spray in April, but, if you wait until late May, I would suggest using from 1¼ lbs. to 1½ lbs. either with your regular lime sulphur spray, or with plain water, remembering, however, that if you have a late March or April bloom instead of the regular February bloom, arsenical spraying cannot be expected to mature that fruit for shipment as early as if you had had a February bloom, for, regardless of how we might fertilize, cultivate or spray, fruit must have a certain length of time in which to mature and the juice contents in our maturity laws are a safeguard against the shipment of dry and immature fruit which might pass the acid tests, and as much as I advocate the use of arsenic on grapefruit, I would today oppose it, except for our laws governing the juice contents of various sizes.

During the time it was a violation of the law to use arsenic on grapefruit, I tried everything anyone would suggest in an effort to sweeten my grapefruit: I put arsenic in my fertilizer, I sprayed with other chemicals, recommended by some of my good chemist friends, I gave my trees hardwood ashes, I gave them one year, 20 lbs. of acid phosphate to the tree, in addition to the regular fertilizer application and many other experiments, but all without any results and if there has been anything found to replace arsenic, I have failed to reach that information, therefore, I am convinced that the proper usage of arsenic on grapefruit will allow the industry to put on the market in November and December grapefruit which is sweeter than it would be in February, had it not been sprayed and with the ever increasing production staring us in the face, it behooves each of us to do everything possible to increase the consumption of grapefruit and it is my belief that this can be done, if we give the consuming public sweet grapefruit early in the season.

The major portion of my orange holdings, in the past, have been of the Valencia type and, naturally, I have never interested myself, to any great extent, in the early maturity of oranges. I do, however, at the present time, have, in various groves, a rather large production of Pineapple, Jaffa and other mid-season varieties and, for the past three or four years, I have undertaken to move them early, but am frank to admit that about the only way I have been able to make them mature early enough to pass the maturity test for the Thanksgiving market, is by getting an early bloom and then fertilizing heavily with potash. I have never used arsenic on my oranges, as it has been a violation of the law, since I first

began to try to move my early oranges in November, but I have used other suggested sprays and there may be some spray, known to some growers, which will reduce the acid, but all of these sprays, suggested to me and which I have tried, have seemed to have no noticeable effect. I do think, if we are willing to take the cold risks, we can have our Pineapple and other mid-season varieties of oranges ready for the Thanksgiving market by fertilizing rather heavily in October and November and by irrigating in January, if we have a moisture deficiency at that time. I have one Pineapple grove which I had never been able to move early and, in October of 1935, I gave them an extra heavy application of fertilizer and during the fall and winter of 1935 we had regular rains and in January of 1936 I irrigated this grove thoroughly and secured a late January and early February bloom which did mature early and pass the maturity test and was picked on November 14th, 1936. It was my intention the next season to follow this same procedure on this and another grove, but I realized that I might be running a risk by fertilizing in October, so instead, I let the trees go dormant and I did not fertilize until early January and did not irrigate and the bloom was, at least, three to four weeks later than in the previous year, when I fertilized early and irrigated in January, consequently, those Pineapple oranges did not pass the test until too late for the Christmas holiday market, so I am about convinced that, in order to make Pineapple and other similar varieties of oranges pass the maturity test early, we must get an early bloom, which I feel we can, if we are willing to have our groves bud and bloom in late January—this can be done with fertilizer and water. I think that practically all of our mid-season oranges, including seedlings, have sufficient juice to enable them to be moved by Thanksgiving, but, because they carry high acids, certain varieties will not pass the acid test, even for the Christmas holiday trade, although they are as well matured as some of our early varieties which are low in acids, and I am wondering if the seedling growers, a large number of whom are now being forced to hold their fruit until after Christmas, are not wondering if the now existing maturity laws are entirely fair to the owners of seedling groves. I am not, at this time, going to advocate the repeal of the arsenic laws, affecting oranges, for, naturally, growers, whose holdings run heavily to Parson Browns, Hamlins and other varieties, low in acidity, would vigorously oppose any arsenical suggestions, but there is certainly food for thought in this suggestion, for I am convinced that, even though Pineapples, Jaffas, Seedlings and other varieties which are high in acid contents, bloom the same day as other varieties which are known to be low in acidity, there is nothing much we can do in the way of fertilizing, cultivating, or spraying which will lower the acidity and make them pass the maturity tests as early as those varieties which are *no more mature*, but which are low in acidity. I do hope and trust that, sometime in the future, some ways and means may be found for lowering the acidity in seedlings and other mid-season varieties which are fully matured in December, but which will not pass the acid maturity test for the use of "Color Added" until late in January.

I am not a heavy producer of tangerines, but those I do produce are a real problem. You will recall the test on tangerines this season was raised from a ratio of seven to one to a ratio of seven and one-half to one, and I am not criticizing this change, for I realize that a sour tangerine is about the poorest thing in citrus that we could offer the consuming public and even a tangerine which passes the present existing maturity test of seven and one-half to one is still rather sour and tart and why the public still consumes such a large volume in November and December is a mystery to me and convinces me that there is a real place in the picture for our tangerines. And if these tangerines were sweeter in November and December and would pass an acid test of eight or even eight and one-half to one ratio, I think we could reasonably expect a much larger volume to be consumed early in the season, but we know that we cannot expect tangerines to pass a test of this kind in November and December.

Prior to last season, the required State maturity test on tangerines was a ratio of seven to one and when tangerines reached that point, we naturally ceased making tests, and now I am wondering and concerned to learn if tangerines on rough lemon root on high pineland will ever pass the

present maturity requirements in time for the holiday trade. In discussing this situation with a number of the leading packers in my territory, they seem to be of the opinion that our present maturity test on tangerines is too high in order to move a large volume, for the holiday trade, but not too high in order to assure us of having palatable tangerines and even admitting that they would be much more acceptable if they could pass a test of even 8½ to 1 ratio. My observation has been that tangerines are more or less a holiday fruit, but, since we are spending five cents per box on the State's output for advertising purposes, it may be possible to extend the heavy consuming period after the holidays and into January and February, but those growers who are familiar with the situation know that our tangerines, on rough lemon root, begin to show dryness rather early after the holidays, and, naturally, when this condition begins to develop there is a rush to move these tangerines, regardless of price conditions.

A number of my good friends, last Spring, sprayed their tangerines with a very small amount of arsenic, using only from three to four ounces to the one hundred gallons of water, and I understand that their sprayed tangerines passed an acid test of from eight to nine ratio to one in November and December, and those friends not only received a good price for their tangerines; not only moved them from their trees before any chance of dryness, but gave the public a real sweet tangerine, a much better fruit than those which would just barely pass the ratio test of seven and one-half to one. A large amount of tangerines were never shipped this season because they began to show dryness before they would pass the even present low test of 7½ to 1, but even so, I would not, at this time, recommend reducing the test to the old standards of a ratio of seven to one, but, unless there are some good arguments which I have not heard, I can see no reason why some constructive study should not be made of the arsenic effects on tangerines. I realize that these remarks will be criticized by a number of my good friends, who are constitutionally opposed to even the word "arsenic," but those growers, who did use arsenic last year, if promised immunity, should be able to give convincing testimony as to the superior eating qualities of sprayed tangerines and if it be true that a light application of arsenic, not over three or four ounces to the one hundred gallons of water, will cause tangerines to pass a ratio test of from eight to nine to one during the holiday season, then it seems to me that the leaders of the industry should, by all means, get together and, before the convening of the next Legislature, arrange to make some changes in our arsenic laws. Spraying tangerines should not cause the same objections to be raised that might justly be raised in connection with spraying oranges with arsenic, for so far as I have been able to determine, we do not have in tangerines what is known as a strictly early variety, such as the so-called early varieties of oranges, Parson Browns, Hamlins, Walkers, Norris Seedless, and the numerous other *so-called* early varieties. Tangerine producers of the State are now on an equal basis and if the laws were changed to permit the spraying of tangerines, no grower could claim that such practices were detrimental to his interests, because of the fact that he had a natural early variety of tangerines which would pass early the now existing State maturity tests.

It is the desire of practically every grower to move his tangerines in November and December, partially on account of the cold risks, and partially on account of the possibility of his tangerines showing dryness and becoming puffy, if held until late in January or February, and we all know, from experience, that we receive more money for our tangerines, if shipped in time for the holiday trade. If, by using a small amount of arsenic on our tangerines, we can make them sweet for Thanksgiving and Christmas and thereby be able to move, probably, twice as many during that period as we have been accustomed to in the past, then it appears to me that we should certainly begin, immediately, to give some thought and study to this situation and arrange to give this information to the tangerine growers of the State.

I have made several natural efforts to mature tangerines early, but without any great amount of success. This past season, or rather the season just coming to a close, my tangerines bloomed early and regular and I thought that I would be

able to move a goodly portion of them for Thanksgiving, but, much to my surprise, they did not even pass the new test of a ratio of 7½ to 1 in time for the Christmas holiday trade and, consequently, on account of dryness and a puffy condition, I lost around 3,000 boxes. It might be said that this early dryness and puffy condition was due to our extreme cold weather, but after a number of years of raising tangerines, I am convinced that we growers, who have them budded on rough lemon root and planted on high pineland, cannot afford to hold them until late January and February. I now have an extreme early bloom and have irrigated them twice already and have given them an application of fertilizer, runninig high in potash, and shall watch with a great deal of interest their maturity this fall.

I regret, exceedingly, that I am unable to give to the growers any particular cultivation or fertilization formula for hastening the maturity of either oranges or tangerines, but I do think that the system, used by my old Uncle, in south Alabama, might well be used to advantage by some of us Florida citrus growers. When being asked for his formula for raising such fine crops of cotton, corn and oats each year, he replied that the only system he used was: "Early to bed, early to rise, work like hell and fertilize."

In closing, I wish to compliment Mr. Mayo, Mr. Taylor and their high class organization on the most excellent packing house inspection work they have been doing for the past several years. Mr. Mayo has been able to give his men longer employment than in the early days of the Inspection Service and he has been able to build a high class, highly respected organization and I feel that his inspection personnel has had considerable influence and much to do with crystallizing public opinion in favor of our maturity laws.

MATURITY IN CITRUS FRUITS

C. E. STEWART
DeLand

Mr. President, members of the Florida Horticultural Society, ladies and gentlemen:

The subject assigned to me for tonight is "Maturity of Citrus Fruits." I don't know why I was chosen to speak on this particular subject—I am flattered but I believe the subject is worthy of a more experienced grower and a keener brain.

Maturity is, in my opinion, something everybody is interested in but nobody knows anything about. Just what a mature orange is, is a controversial question—how to grow what we can't exactly define is still more actively controversial—and how to market this mature article we can't define and can't agree on how to grow involves further disagreement. This last is so well known that some four hundred agents are able to make a living off the grower by claiming to have something different in the way of marketing. The controversial jumble is made complete when one realizes that with all the brains in the industry no one method has had general approval as the best way to do anything. And out of this clutter of honest opinions some one suggested that I talk about maturity, so, I am about to add to the general confusion.

Now a request from Professor Floyd to serve on this program is a mandate from an honored Society and a call it is an honor to receive and obey—so, here I am to say something about maturity. However, my talks have one redeeming feature, as old Artemus Ward once said, in that what I say has very little to do with the main subject.

The interest in establishing a maturity standard for citrus is, of course, to make citrus groves profitable by protecting the consumer and holding him for a customer. I am not going to bore you with a review of progress made in establishing maturity tests although I have been in most of it since the early days—days of the real green fruiters—when all we could do was to fix a standard of half color. It has been a long hard

road but better fruit is going into the early markets every year.

However, bear in mind one fact in this maturity business—our crops are getting larger and rigid standards tend to shorten the shipping season—coupled with this is the well known fact that although orders come in with a rush as the season opens there is a lull as soon as the trade has once been supplied. The reasons for this should be equally well known. First, fruit that meets the test may not be so very good to eat, second, if it has been cooked in the coloring room, it is a poor keeper. Third, if it has been handled properly it is an excellent keeper and will lie on the wholesaler's floor for weeks before breaking down. So the trade is in the position of either having a slow moving fruit on the floor that is sound and he feels must be sold before he buys more or he is pushing fruit that is breaking down rapidly. Of course these are the extremes—there are many grades of the same situations in between—all unsatisfactory to the trade. I believe this situation develops because we ship a poor eating fruit, and consumption is slow. Therefore we must give the consumer a better eating fruit early in the season—this means higher standards—that is exactly what it means. But, you cry, what about further shortening the season? I'll get to that in a minute but I want to bring out a few more points first. For the past three seasons we have been advertising Florida citrus to the consumers and particularly to the housewives of America. We have been telling them certain definite things—facts which have interested them greatly and which the most casual check shows have widened our markets tremendously. These definite things we have ballyhooed about are certain characteristics that Florida fruit has. As I said before, these are forceful statements and a buyer of Florida fruit expects to find them substantiated when the fruit is in hand. Therefore we have been careful not to start advertising until reports showed that fruit was giving satisfaction. What are these claims we advertise—we publish many recipes and play up the health value and all possible angles but the foundation of it all is first, juice and second, good to eat as is.

Let us consider first—juice. Immediately the question of grade comes in. In the beginning of the season fruit may pass the test but, perhaps, it should be thrown out on quality. Now if we had the right grading rules this situation would not arise. I have never been in favor of the present grading rules. They were started about twenty years ago and are based on the California system of grading which is entirely unsuited to Florida—that is the first point of objection—second, the names of the grades are unfortunate—I submit that in the grade name US No. 2, that No. 2 smacks of second class. I like the original brights, goldens and russets—these names are distinctly Florida's and a golden is a first class fruit. When I was with the Exchange we once advertised in this manner—*Buy the Brights, they are as good as the Russets.* When the present citrus laws were established the Citrus Commission was empowered to set the grades under which the fruit would be divided and shipped. I was in that too but I didn't get to first base with my ideas about a juice grade. I am firmly of the opinion that an impartial study of this grading situation will show that we are wasting a lot of time and money in the wrong sort of standardization—that our grading is not tuned to our advertising—that it is impossible to tune our advertising to our grading—that we are fooling our consumers—that we are penalizing the producers of the best fruit—fruit that has both fine appearance and fine eating quality. To attempt to ship a uniform US No. 1 from all sections of the state is silly—any fruitman knows that No. 1's from the five main sections of the state, if assembled can easily be divided into five distinct grades. I know this is unfair to the man packing the best. To the trade a US No. 1 is worth so much—but we know some brands are worth more than others. In a measure the trade knows this too but they are in an ideal position to play one brand against the other. Lower brands are not pulled up—the best brands are pulled down. I propose that every shipper have the right to fix his own grades under his own brands—to succeed he must defend them but grade to the best advantage of the fruit in his particular section. To make him grade as the whole state does is unjust and a very dumb procedure. The state regulation would come in by seeing that every box of first grade

fruit contained five gallons of juice—second grade four gallons and a half and third grade four gallons—less juice fruit would be culls. Then the housewife, enthused by our advertising, encouraged by her doctor, spurred on by her children, would not buy US No. 1's at a good round price and find them perhaps ricey and almost juiceless. What a travesty on a square deal—what a foolish procedure—what a costly and ruinous system. I know that when probably 80% of all oranges are consumed as juice—when we claim and advertise that our fruit is the juiciest—when we do produce such oranges, that it is our job to see that such oranges get into the better grades and nothing else. Now as to the second point—that they are good to eat as is. It would be a poor practice to advertise that sugar must not be added so, while we do not touch on this particular point in our copy it is there by omission. We advise the drinking of orange and grapefruit juice, we show pictures of fruit dripping directly into glasses. We publish many recipes but none for the raw juice. Therefore the juice of the first fruit shipped must be palatable, it must have a bland flavor for, remember the consumer has just been having the lush, ripe fruit of late summer and fall and his palate will not react favorably to any harsh acids. In fact investigation shows that the northerner prefers, what we would term, insipid fruit. If you doubt this, check it and you may learn one reason why we are losing early markets to Texas. These statements, if they are true and I believe they are, lead to one conclusion—the first fruit must be juicy and bland. I am in favor of a high test—of raising the test requirements, if necessary, but I am unalterably opposed to shortening the shipping season. On the other hand I am in favor of using every means at our command to start as early as possible. Perhaps you may have guessed that I am getting around to talking about the use of arsenic. We, in Volusia County, never knew it was being used on oranges and tangerines until about last year and then we found out that it had been used by some in south Florida for about fifteen years. This is also a very controversial subject and I will try to irritate as little as possible those of you who have contempt for the use of arsenic, by mentioning just a few points that I consider necessary to reconcile this short presentation. It is unfortunate that the name of this material has such unpleasant associations—it is known chiefly as a deadly poison—its therapeutic value is almost unknown to the average man—yet is is a favored stimulant in treating anemia and as fowler's solution has a multitude of daily uses. But when we think of arsenic near our beloved oranges we rear back in horror. I wonder if any grower has ever tried bluestone in soup or contemplated what calcium nitrate does to a pair of leather gloves—yet these violent chemicals are used daily. Arsenic seems to be tonic to the tree when given in small doses. At any rate I believe that properly used it will solve our early marketing problem—lengthen our shipping season and give that bland flavor so necessary in our initial offerings. When there is still plenty of acid in the fruit it makes for a fine flavor—later in the season on early and midseason varieties it is not so hot. However, here is a suggestion: why not make the users register their grove with Mr. Mayo's department, apply it under his supervision, the grower paying the inspector, and such fruit must be off before the first of December. This of course does not apply to Valencias. On some varieties arsenic seems to cut down the juice—well if we had a juice grade growers would be careful what they used arsenic on and the consumer would be fully protected. Because of arsenic's bad record as a poison—being involved in murders, suicides, grudge dog poisoning and the like—research is directed for something else to step up maturity, meanwhile industry languishes. I am told manganese will do a lot in a year and a man at Pierson advertises a compound to put on the ground. I would like to see an immediate and impartial study of arsenic made at once for this season. I believe Joe Taylor has right on file now sufficient data to boost a committee over the experimental work. The Quakers were pledged to peace but they made grand soldiers. We need bland early fruit, we know how to get it—let's not be too straight laced to do it. Maturity is a factor right through the season but my observation is that some years the trees call their fruit mature when it has not progressed as far in sweetness as it has other years. This decision on the part of the tree to call it a day is indi-

cated by color and I suggest that color must always be a factor in determining maturity. One hundred and twenty hours in the coloring rooms makes for a lot of mush in the markets and an orange that needs more than sixty hours is a pretty sorry fruit. Such a ruling would also act as a brake on the unscrupulous use of arsenic. Certainly long hours in the coloring rooms have made excessive decay a common thing in the early shipments when our early fruit should be our best carrier.

It is not my purpose to go into a technical presentation but to get it into the record I wish to say that in my opinion the grapefruit test is all right with the exception of the way it operates on small sized Duncans. The Commission can alter this ten per cent. either way but I doubt if that will be enough. I believe that on oranges and tangerines there is need for a sliding scale too. In my county this year the tangerines never did pass in any quantity, even in January, yet they ate better than those we brought up from South Florida for purposes of comparison. You can make lemonade out of a gallon of water, one lemon and a dash of sugar but you make a better drink with a pound of sugar and enough lemons to make it really tart. That is exactly what happened to our tangerines, there was enough juice and sugar to make them eat well but too much acid for the test. It cost Volusia County untold thousands of dollars. A way to change this before next season must be found. The Commission has no authority but Mr. Mayo, I believe, would be safe in recognizing a popular demand and an industry need. Last year Joe Taylor made one of the soundest—if I may use such a term—soundest suggestions ever presented to the industry—a way to stop the mixing of immature fruit with high test fruit. This is a piece of chicanery that has long been practiced on the innocent consumer. It should be stopped and can be a simple tolerance of the undertest fruit in any lot. That was Joe Taylor's idea and it was turned down—one wonders why. A housewife who buys a dozen oranges only to find six are bitterly sour is a lost customer and a bad advertiser.

The Florida Citrus Commission is starting a good program, well thought out, for a most thorough study of this maturity question. We are getting splendid cooperation from all state officers, who are putting their time and funds into it, as well as the support of the Experimental Station, and sound progress is assured. However, I feel that the coming large crop calls for action before this fall, if a major disaster is to be avoided. Grapefruit is in a pretty good spot. Oranges and tangerines are in an entirely different position. If maturity cannot be hastened on tangerines then the test should be lowered to 6½ to one. Tangerines enjoy a short season and must be moved in that time, therefore the tangerine test should be taken up right now.

I wonder if the Horticultural Society would like to appoint a committee to report on the present test and methods of getting a longer shipping season, quality of early fruit, grading, etc. No one could possibly question their motives and they have the brains within the society to do a grand job.

I believe that is all I have to say. I wish this subject had been given to a more able grower—it deserves the best—however, I thank you for listening.

CITRUS FRUIT MATURITY

J. J. TAYLOR
State Chemist
Tallahassee

I come now to the subject which was assigned to my good friend, Mr. C. E. Stewart of the Citrus Commission, and myself, to discuss "Citrus Fruit Maturity." I feel that this subject on the program should have been followed by a question mark or the symbol X to denote the unknown, because if there ever was an unknown quantity, I think it is Citrus Fruit Maturity.

We take for example: on or about the first of October you go through your grove, we'll say of mid-season oranges, you pick an orange from the tree—you cut it with your knife, trim off a piece and taste it—you frown and pucker up your lips, you throw aside, you *know* it is *green,* unpalatable and not fit to eat. On or about January 15th you again are taking a walk through the same grove. You stop at the same tree, you pick an orange from the same limb; you proceed to taste it in the same way, but what happens this time? A pleased expression comes over the face, a look of pleasant anticipation—you peel the remainder of the orange and eat it. Why! What has happened between the two visits? The orange has matured. How do you know? Because you want to eat it. At just what point between these visits did the orange become mature? We don't know! If we did we would have the answer to the maturity problem.

You have already heard a great deal on the subject of Maturity of Citrus Fruits and the Marketing of Citrus Fruits, etc. It is not my intention to bore you with a long discussion of the maturity tests which are now written into the law, and it is not my intention to suggest what changes, if any, should be made.

The present maturity standards do not represent recommendations of the Citrus Inspection Bureau any more than they represent the single ideas of any one group—they are a compromise of many suggestions and many recommendations which several groups worked out and presented to the Legislature, and which were even modified and compromised after reaching the Legislature. So whether they are good or bad, no one individual can receive all of the credit or all the blame.

So far as our present setup of citrus laws is concerned, there are only two points that I wish to bring out concerning them, and they are both omissions; they were both suggested to the legislative committee and I believe included in the first tentative draft of the bill, but were finally voted out before the final draft of the bill was made.

I believe if these two points had been left in the law it would have made it a much stronger and better maturity law. The first one was intended to prevent the mixing of immature with mature fruit so that the entire lot would pass on a composite test.

It simply provided that no lot of oranges may contain more than 10% of fruit which failed to meet the passing ratio when tested individually. Had this clause been retained in the law, I believe it would enable us to break up one of the oldest and worst practices of unscrupulous shippers; that of mixing immature fruit with mature fruit.

In order to emphasize the importance of the second point I have in mind, I wish to ask any shippers present, what is the worst thing you have to contend with in the shipment of early fruit? If every shipper in the industry was asked that question, I believe ninety per cent. would reply without hesitation, "DECAY." Decay in September, October and November probably costs growers many hundreds of thousands of dollars. It is not my intention to give you a discourse on what causes decay, or how to stop it, I simply want to call your attention to what every grower, and certainly every shipper, already knows, and that is that the longer fruit is kept in coloring rooms at high temperatures the more decay it will show when it finally reaches the market—

if it ever does. There are two good reasons for this; one is the longer the fruit stays under gas, the weaker it becomes; and the second is the longer it stays at high temperatures, the more rapid the development of the bacteria or fungi, which causes decay. The second point I had in mind with regard to our maturity law was intended to *lessen* (not stop) but lessen decay in shipments of early fruit. In my opinion if we could lessen by 50 to 75% the decay in early fruit, we would do more to establish confidence among dealers in Florida fruit than any other single thing we could do.

There was a section suggested in the law that read as follows: "It is further recommended that before oranges shall be picked for commercial shipment, 50% of the surface of each fruit must show a tinge of yellow or orange color."

This also was voted out of the final draft of the bill. This recommendation was made solely for the purpose of cutting down on the time required in the coloring room under gas so that early fruit would have better carrying and keeping qualities. Fruit that has to stay under gas 90 to 100 hours before it can be shipped, cannot be expected to hold up after spending several days in transit to the market, and will most certainly rot in the housewife's pantry if kept more than a day or two.

It seems to me that the whole question of maturity has been approached from the wrong angle. It has been the practice to set the standards just as low as an orange could be considered edible instead of just as high as it could be produced and maintained—and another point is that the same standard is set for all oranges regardless of their characteristics. Everybody knows and concedes that the 8 to 1 ratio is too low for early oranges, or for all oranges of the type having low acid and low solids. And everybody knows that the amount of early oranges we have to market is increasing by leaps and bounds. It may be a workable standard for oranges of the seedling type having high acid and high solids and which never attain a very high ratio, but for some types of oranges it is entirely inadequate.

If there were as much energy and effort expended in putting quality, eating quality and carrying quality into our early oranges as there is in studying ways and means of getting them by the inspector and the maturity laws, the whole industry would be better off. If we could put the same eating and keeping qualities in the first five hundred cars of oranges we market each year that is put in any five hundred cars shipped in January or February, our marketing problem would be solved, because consumers want good Florida oranges. They don't want the kind we send them in September and October. Why was it that last Fall you could sell early Parson Browns and Hamlins for $1.75 per box on the tree in October and you couldn't sell the finest mid-season oranges for 6 cents per box in January? And yet these same mid-season oranges are the finest fruit that Florida raises and are conceded by all Floridians to be the finest fruit in the world.

Is it possible that our 8 to 1 early oranges are not as good as we have been told they were, or as our advertising experts tell the consumer they are, or is it that we just give them too many? Is it that our standards for early oranges are too low or is it because they decay too rapidly in the consumers' hands? Why is it that year after year we start off with good prices for early oranges and before the first one thousand cars have been shipped, the price has dropped from one to two dollars per box? These are the questions which have been confronting citrus growers for the past thirty or forty years, and probably will be confronting them from now on. What I am particularly interested in is what relation does the maturity of our fruit bear to this condition and what, if anything, can our maturity standards do to help it? In my opinion the citrus industry of Florida is not going to make any material headway towards improving the condition of the citrus market until we find a way to grow a better quality of early orange and put that orange on the market in a condition that it will keep longer in the housewife's pantry, and that cannot be done by changing a maturity standard.

There are many factors entering into the production of quality fruit. Maturity is a very essential one and needs much study, but it is by no means the only one. The production of quality fruit begins with the soil and root-stock; it goes

on down through the fertilizer and spray program; it is affected by pruning and cultivation practices, and it does not stop there; it goes right on to the picking and handling of the fruit before it reaches the packing house, and the processing and packing of it after it reaches the packing house. It does not even stop there—it goes right on to the manner of handling and shipping it after it leaves the packing house, and right on until it reaches the final consumer.

Every different phase mentioned here is a study of its own. The selection of soil, of root-stock, of budwood, fertilization, cultivation, spraying, pruning, picking, handling, processing, packing, pre-cooling. Every one is a subject which deserves study and which plays a part in producing quality fruit. If all of these subjects are studied and standardized and the best answers obtained to them; then perhaps we will be in a better position to arrive at better maturity standards for citrus fruits.

And in the meantime if some of our chemists can corral some of these elusive and complex chemical combinations which gives the mature orange its characteristic aroma and flavor and give us some test besides our sense of taste to determine when it is present or absent, we may find a real test for maturity.

HISTORICAL INFORMATION

S. O. CHASE
Sanford, Fla.

Sanford, Florida, February 1, 1938.

Mr. E. W. Brown,
DeLand, Florida.
Dear Mr. Brown:

A few days ago I received copy of the Proceedings of the Florida State Horticultural Society for 1937, and on page No. 134 of that publication I found copy of a letter addressed to you, dated Chicago, March 22, 1937, signed by W. E. Clow.

That letter, with reference to the history of grapefruit, is very inaccurate in several ways, and I think some of the points should be corrected.

I arrived in Florida in December, 1878, and my first work was on the Belair Grove, which then belonged to General Sanford. I worked on the grove for over a year, and at that time there were no grapefruit bearing. There were several Pomelo and Shaddock, which are not edible. In 1880 I was discontinued on Belair, but continued in the employ of Mr. Ingraham, who was General Sanford's agent, and from that date until the present time I have always been connected with the grove and the operation of same. Mr. Flagler never had a grove in this vicinity. In 1892 Mr. Ingraham, in the interests of the Land Department of the old Plant System, made a trip through the Everglades, starting from Fort Myers and entering the sawgrass area at Fort Shackleford, heading southeast for Miami. The trip was made in March, 1892. After reaching Miami we spent several days with Mrs. Tuttle, with whom both Mr. Ingraham and I were acquainted as she frequently visited some mutual friends near Sanford. At that time Mrs. Tuttle gave me an option on 10 acres of land lying north of the Fort Dallas property, and facing on Biscayne Bay. At the time she said she could not make an absolute sale of the property for the reason that titles were being cleared up by a lawyer named Robbins, who lived in Titusville. After making this trip through the Glades, getting information desired by the Plant System, Mr. Ingraham was employed by Mr. Flagler and was put in charge of the East Coast Land Department and appointed one of the Vice Presidents of the Florida East Coast Railroad. Mr. Ingraham was responsible for getting Mr. Flagler and Mrs. Tuttle together shortly after the East Coast road was extended to West Palm Beach. Mrs. Tuttle wrote me and told me that she was negotiating with Mr. Flagler with reference to having the East Coast Railroad extended to Miami, and she wanted me to release the option she had given me on that particular 10 acres of land, which was later known as Palm Park, and I think is now the property of the City, promising to give me another opportunity to select 10 acres on the Bay,

which selection I failed to make. Mrs. Tuttle died during the period of the Spanish-American War.

I think Doctor Hume's book gives a very good description of the origin of the grapefruit. My first experience with grapefruit was March, 1879, when I was returning on foot from a trip I made to Tampa and Manatee on the west coast, and was following what was then known as the "wire road," along which the telegraph wires running from Wildwood to Punta Rassa were strung. There was one large grapefruit tree standing near a rail fence which separated the highway from a log cabin, near Ft. Meade. At that time I could not understand how such beautiful fruit could be so close to the highway and remain undisturbed. I found the house was vacant, so helped myself to the fruit. Not knowing how to eat the grapefruit I did not make very much of a success in the first attempt, so threw the grapefruit away as I thought it was too bitter to eat.

I do not know that anything can be done to correct the statement of Mr. Clow's but thought I had better set you right on the matter.

Yours very truly,

S. O. CHASE.

NECROLOGY REPORT

Each year we pause for a few moments at our final meeting to pay tribute to those whom the Angel of Death has called from our midst during the year which has passed.

This year we mourn the loss of Mrs. H. G. Hastings, the beloved wife of a very loyal member of many years, who has given freely of his time and unusual ability to further the work of our Society.

We mourn also the loss of C. W. McLennan, Geo. Speese, and W. S. Hart, who was Secretary of the Society from 1891 to 1893 and Treasurer from 1897 to 1927.

And, finally, we mourn our President, C. W. Lyons, affectionately called "Joe" by his legion of friends, cut down in the flower of manhood while still vigorous and active and loved by thousands.

Suitable mention has already been made in our Proceedings for same. Your Committee will secure the necessary information regarding the others for the forthcoming Proceedings.

We will ask that our members stand for a moment in silence in respect for their memories, after which Rev. Childers of the Winter Haven Presbyterian Church will lead us in prayer.

F. M. O'BYRNE, Chairman.

Prayer.

The bugle sounded taps.

BUSINESS SESSION

Chairman: We will now listen to the reports from the Secretary and the Treasurer. Unfortunately Mr. N. A. Reasoner is unable to be present here but we have his report and we will now listen to both these reports being read.

SECRETARY'S REPORT
April 11, 1938

Balance Sheet		
Cash in Banks	$ 90.26	
Check Not Deposited	2.00	
	$ 92.26	
Liability		
B. F. Floyd	$414.00	
Deficit		($321.74)
Statement of Operations—1937-38		
Annual Memberships, 1937	$ 370.00	
Annual Sustaining Memberships, 1937	40.00	
Annual Memberships, 1938	10.00	
Life Membership	25.00	
Donations	420.00	
Sale of Advertising Space	705.00	
Sale of Proceedings	73.21	
Overpayment	2.28	
	$1,645.49	
Expenses—28 Items	2,044.52	
Deficit	$ 399.03	

Cash Receipts		
Balance April 12, 1937	$ 841.29	
Receipts	1,645.49	
	$2,486.78	
Disbursements		
Expenses (See Operating Statement)	$2,044.52	
Transfer of Funds to Treasurer 1/21/38	350.00	
Cash in Banks	90.26	
Check Not Deposited	2.00	
	$2,486.78	

ANNUAL TREASURER'S REPORT
N. A. Reasoner, Treasurer
April 12, 1937-April 12, 1938

Balance on hand at time of report, April 12, 1937	$142.28	
RECEIPTS:		
106 Annual Memberships, 1937,	212.00	
155 Annual Memberships, 1938,	310.00	
1 Copy back number Proceedings	2.00	
Advertising in 1936 Proceedings	15.00	
Advertising in 1937 Proceedings	37.50	
Check from B. F. Floyd, Sec'y, collections	350.00	
		$1,068.78

DISBURSEMENTS:	
E. O. Painter Printing Co. bal. 1936 Proceedings	$190.00
E. O. Painter Printing Co. on acct. '37 Proceed	314.05
Clarke Barney, bond, '37	12.50
Clarke Barney, bond, '38	12.50
Prompt Printery, Env. & Letterheads	21.25
Postal Tel. Co., advertising telegrams	3.42
Helen W. Curtis, stenographic rep't at meeting	94.00
Treasurer's Conv. Exp.	22.25
Office supplies (Carbon paper, typewriter ribbon, sec. sheets, stamp pad)	2.00

(*Continued*)

DISBURSEMENTS—(*Continued*)		
Office and Sten. Exp.	31.00	
Stamps (for membership campaigns, mailing receipts, and genl cor.)	48.79	
		$751.76
Balance, April 12, 1938		$317.02
$317.02 Our Balance		
12.50 Clarke Barney check ,still out		
$329.52 Bank Balance		

Mr. N. A. Reasoner, Treas.
Florida State Horticultural Society,
Bradenton, Florida.
Dear Sir:

We beg to advise that your balance in the Florida State Horticultural Society account through April 11th, 1938, is $329.52.

We also hold for you the following United States Savings Bonds:

4. $1000.00 Bonds Series C, Due 10 yrs., Nos. M314062C, M314063C, M314064C, & M314065C
4. $100.00 Bonds Series C, Due 10 yrs., Nos. C354407C, C354408C, C354409C, & C354410C.

Very truly yours,
JAS. H. DAUGHTREY, JR.,
Assistant Cashier.

Mr. Brooks: I presume we might just as well act upon these reports at this time. What is your pleasure? Motion was made and seconded to accept and adopt the reports both of the Secretary and the Treasurer. The motion carried. Mr Brooks announced the reports of the Secretary and Treasurer approved.

REPORT OF AUDITING COMMITTEE

We, the members of your Auditing Committee, beg to report that we have examined the books, vouchers and holdings of the Secretary and Treasurer and find them to be correct, except that the Treasurer has apparently failed in include in his report any reference to the cash balance in savings account belonging to the Endowment Fund which, at the date of last report, amounted to $68.86.

The Treasurer is being asked to complete his report with verification of balance shown thereon.

Respectfully submitted,
E. L. WIRT
FLOYD L. WRAY.

Motion was made and seconded that the Report of the Auditing Committee be accepted and placed on file. Vote was taken and the motion carried.

Note: Accounting of balance in savings account has been made by the Treasurer and details will appear in 1939 Proceedings. Secretary.

EXECUTIVE COMMITTEE MEETING

November 8, 1937
Haven Hotel, Winter Haven, Fla.

A call meeting of the Executive Committee of the Florida State Horticultural Society was held in Winter Haven on November 8, 1937, at 8:00 P. M. at the Haven Hotel. There were present Messrs. F. M. O'Byrne, C. I. Brooks, W. F. Ward, Dr. H. S. Wolfe and B. F. Floyd of the Executive Committee present, with the following visitors, E. L. Wirt, W. W. Yothers of Orlando, H. C. Henricksen of Eustis, E. B. Walthall of Winter Haven and a representative from the Cypress Gardens.

The publication of the 1937 Proceedings was discussed and the Secretary was authorized to proceed with the printing. The edition was limited to approximately 100 copies in excess of the actual number of members at the time of going to press. Upon motion duly carried, Acting President Brooks appointed F. M. O'Byrne a com-

mittee of one to secure quotations on the publication and to name the publisher, with the understanding that no change would be made in publishers unless there was a substantial difference in price quoted below that submitted by the Company that had been publishing the Proceedings.

Upon motion, unanimously carried, Acting President Brooks named Mr. F. M. O'Byrne and E. L. Wirt as a committee to draft resolutions of condolence and send to Mrs. C. W. Lyons and family at Tampa.

Upon motion of Dr. Wolfe, seconded by Mr. W. F. Ward and unanimously carried, Mr. C. I. Brooks of Miami was appointed President to serve during the remainder of the term of President C. W. Lyons, deceased.

Upon motion of Mr. Ward and seconded by Dr. Wolfe and unanimously carried, President Brooks was requested to appoint the various committees for the 1938 meeting. Mr. Brooks appointed Mr. E. L. Wirt of Babson Park and Mr. Leo Wilson of Bradenton on the Auditing Committee but deferred the remainder of the appointments until later. A resolution was adopted to allow the Committee expense money as needed but not to exceed a total of $25.00.

The details of a membership campaign were discussed and President Brooks appointed Messrs. W. F. Ward and H. C. Henricksen to serve with himself as a Membership Committee, with W. F. Ward as Chairman. The Committee was authorized to incur expenses not to exceed $100.00 in their work.

The program for the 1938 meeting was discussed at length. The Secretary, the Chairman of the Executive Committee and Mr. Frank Holland were asked to serve as a Program Committee and to proceed with the building of the 1938 program. It was suggested that an invitation be extended Mr. C. C. Teague of California to address the Society.

Details of the Entertainment Program received attention, and Mr. Walthall of the Winter Haven Chamber of Commerce offered the services of his organization in any manner in which they could help.

There being no further business, the Committee adjourned to meet at the call of the Chairman.

PRESENTATION OF ATTENDANCE CUP
Mr. C. I. Brooks

In checking up we find our attendance record to show that Orlando has the largest number of members present at the Fifty-First Annual Meeting of the Society, and is herewith awarded the Attendance Cup.

This beautiful cup, given to us by the McKee Jungle Gardens, as you know, is to be presented to the community having the most members present at any particular meeting, and if that place has the most three times in succession they keep the cup permanently. The cup has been won twice by Winter Haven. They cannot compete this time because the convention is being held in Winter Haven, but if they will go down to—whatever town we have our next convention, they may win again next year.

This year the cup goes to Orlando and I am pleased to present same to Mr. C. D. Kime of Orlando for that community.

REPORT OF RESOLUTIONS COMMITTEE

RESOLUTION NO. 1

Whereas, this Society, through its representative, Mr. Harry Bourland of Ocala, and his associates, has collected a quantity of antique citrus packing house and grove equipment that is of great historical value; and

Whereas, this material is of such a nature that it cannot be replaced; and,

Whereas, it is the belief of the Society that this material should be preserved,

THEREFORE, BE IT RESOLVED, that the University of Florida be asked to take title to this his-

torical material and provide suitable quarters for its storage and display, and that a copy of this Resolution be sent to the Board of Control of the University and to Dr. Tigert, with the request that serious consideration be given our suggestion.

CHAS. KIME,
GEO. SPANGLER,
C. O. HAMMERSTEIN.

Motion was made and seconded that this resolution be adopted and was unanimously carried.

RESOLUTION NO. 2

Whereas, there are scattered through the state many old neglected groves on which all care has been discontinued. This includes abandoned acreage, city lots or subdivisions or locations unsuited to citrus production, that are no longer fertilized or cared for;

Whereas, such locations are an eyesore and a hindrance to the development of beautification projects and cause much unfavorable comment;

Whereas, these neglected properties are a menace to groves under commercial care, offering an unmolested breeding place for disease and insect pests;

Whereas, they are a constant source of expense to the State Plant Board, due to the cost of occasional inspection;

Whereas, among the state groups we believe to be interested in accomplishing the objects of this resolution are such agencies as the

State Realty Board,
State Garden Club,
State Beautification Department,
City and Towns,
State Chamber of Commerce,
County Governments, and

Whereas, we believe further that some or all of such groups can request co-operation with the State Plant Board and aid in securing this effective assistance,

NOW, THEREFORE, BE IT RESOLVED THAT: The President of the Florida State Horticultural Society be authorized and hereby requested to call this matter to the attention of all such organizations and enlist their active cooperation to the end that such eyesores and breeding grounds be exterminated.

CHAS. KIME,
GEO. SPANGLER,
C. O. HAMMERSTEIN.

Motion was made and seconded that resolution be adopted. Unanimously carried.

RESOLUTION NO. 3

I move that the Florida State Horticultural Society by rising vote commend the Florida Citrus Commission for its efforts to remove from interstate commerce citrus packages of greater than 1 3/5 bushels cubical content; that the Florida State Horticultural Society through its Secretary communicate such action to the Florida Citrus Commission; that copy of this motion be sent to the Hon. Fred Cone, Governor of the State of Florida, that copies of this motion be sent to the members of the Citrus Committee of both houses of the State Legislature at the next meeting of that body and furthermore that the Florida State Horticultural Society urge the passage of a law or laws which would specifically forbid the use of citrus containers larger than 1 3/5 bushels capacity except in movement from the field to processing plant.

Motion was offered by Mr. Howard Phillips, seconded by Dr. J. W. Sample, and unanimously passed.

RESOLUTION No. 4
FINAL RESOLUTIONS

Whereas, this 1938 Annual Meeting has been a great success in attendance—in enthusiasm and especially in cooperation by Winter Haven, our gratitude for this local assistance is unbounded and we do hereby express our heartfelt thanks to Mr. George Andrews of the Haven Hotel, to the Winter Haven Chief, the Winter Haven Herald, the Winter Haven Chamber of Commerce and the Winter Haven Merchants.

We also express our thanks and appreciation to Sheriff Chase of Bartow and to our Trade Papers and our State Papers carrying our A.P. activities and, individually, we thank all speakers who have provided the very interesting and instructive addresses.

Never before have we had the privilege of such bounteous flower decorations and we are indebted

to, and express our thanks for some 200 dozen gorgeous Gladioli furnished by:

Bessemer Properties Inc., Port Mayaca,
Leesburg Bulb and Fern Co., Leesburg,
Pinellas Gladiolus Inc., Clearwater,

and we are equally grateful to the Winter Haven and Gardenia Garden Clubs of Winter Haven for caring for and arranging these Gladioli.

We also express our appreciation to Mrs. A. S. Beymer for providing these glorious Easter lilies at either side of our Speaker's platform.

Our Wednesday afternoon session at Cypress Gardens was most happily spent reviewing the lovely Gardenia Festival in its beautiful natural setting and we express our great thanks to Mr. R. D. Pope and the Cypress Gardens Association.

A great number of our members availed themselves of the invitation to inspect the Jordan Rose Gardens at Bartow and to both Mr. and Mrs. N. E. Jordan we express our pleasure and appreciation.

The Gardenia Garden Club Tea for our ladies was most graciously cared for and again we express our thanks to the ladies of the Gardenia Garden Club.

CHAS. KIME, Orlando,
GEO. SPANGLER, Winter Haven,
C. C. HAMMERSTEIN,
Committee on Resolutions.

Motion was made and seconded that resolution be adopted. Motion unanimously carried.

REPORT OF THE NOMINATING COMMITTEE

Mr. President and Fellow Members of the Horticultural Society: Your Committee on Nominations offers the following nominations:

President—C. I. Brooks, Miami;
Vice-President—T. Ralph Robinson, Orlando.
Vice-President—H. C. Henricksen, Eustis;
Vice-President—F. M. O'Byrne, Lake Wales;
Secretary—Bayard F. Floyd, Davenport;
Treasurer—Frank Holland, Winter Haven;
Executive Committee—
Earl Hart,
W. F. Ward,
C. D. Kime.

Respectfully submitted,
W. J. ELLSWORTH,
E. L. WIRT.

Mr. Brooks: Are there any nominations from the floor?

Motion was made that the nominations be closed and the Secretary be requested to cast the unanimous ballot of the Society for the nominees. Motion was seconded by Mr. Wirt. The Secretary cast the ballot and the nominees were declared elected.

SELECTION OF MEETING PLACE

The Chairman, Mr. Brooks, announced that the final piece of business was the selection of our place of meeting next year and asked—what are your wishes and nominations?

Mr. Floyd L. Wray: Mr. President, Ladies and Gentlemen, about ten years ago our mutual friend, Frank Stirling, here, of Broward County, asked me to attend one of the State Horticultural Society meetings. A bunch of us went and enjoyed it so much we have continued to attend each year and have derived much benefit and pleasure from doing so. So, several of us conceived the idea it would be an appropriate time for us to do something for the Society and it is my pleasure now to bring to the Florida State Horticultural Society and the Krome Memorial

Institute and the Florida Rose Society, greetings from the Hollywood City Administration, Hollywood Chamber of Commerce, Hollywood Kiwanis Club, Hollywood Rotary and Lions Clubs and all of these organizations have asked that a cordial invitation be extended to these groups to make Hollywood the meeting place of the Convention in 1939.

As you know, Hollywood is located just north of Miami Beach, directly on the ocean and is one of those cities comprising the greater Miami area and we have a lot of nice things to share with you—approximately 6 miles of wonderful bathing beach—1 mile of boardwalk—a number of fine hotels and apartments, cafes, businesses of different kinds spread along the boardwalk include chiefly ocean front institutions.

Our Hollywood Beach hotel is one of the largest and most modern of the winter resort hotels in the southland and this hotel has all facilities necessary for entertaining such a group as this. The large convention hall, other rooms for smaller groups and committee meetings, exhibition spaces immediately at hand, full equipment for presenting every phase of your programs, insures a smooth and effective session. In fact, your meetings, social functions and recreational activities are all under one roof, you might say. The hotel is really a city in itself. It has a number of shops, theaters, haberdashery, beauty parlors, own bakery, the hotel is well known for its excellent food and it is right on the ocean which is a feature that will appeal to you. It has its own private bathing beach and any time you wish to put on suits in your own room you can take a special bathers' elevator to the beach, take a swim and order luncheon at the sidewalk cafe, go back to your room, change into street clothes and be thoroughly refreshed to attend the meetings and thoroughly enjoy them.

Mr. Oscar T. Johnson, Managing Director of the Hollywood Beach Hotel also asked that invitations be extended to these societies and groups to hold convention headquarters in this hotel. He will throw open all the facilities, public rooms, convention room, etc., to the Society, and will leave no stone unturned to make this next meeting one of the finest we have ever had. Mr. Johnson is very public spirited. I told him some of the people up here might say—that is such a big hotel down there and it charges exorbitant rates during the winter—so, he said I don't like that word you just used, that is not the case at all, the rates I will give you will sound almost ridiculous in comparison with what we are going to give—the rates for two in a room will be $2.00 each person, $4.00 for the two in the room; superior accommodations will be $5.00, $6.00 for two persons; the single rate will be $2.50, $3.50 and $4.00 each. I then said what about food? He replied you can get fine breakfasts for 40 cents, dandy luncheons for 50 cents and excellent dinners for $1.00.

Hollywood has any number of fine hotels and apartments where the rates are from $1.00 up; there are also modest priced restaurants. We can give you fine rooms and food for whatever you want to pay.

Motorcades may be arranged from the hotel so you may visit the avocado, mango and tropical fruit groves and the residential districts, etc., the groves in the Everglades, the deep water harbors. Hollywood has deep sea fishing boats there for you also, the bathing casino is open to all members, two fine golf clubs where they will welcome you as our guest without charges. Mr. Spangler suggested this evening we have a State Horticultural Golf Tournament and brush up for that occasion and Oscar Johnson told me he would give a fine cup for the winner of that tournament. Also Mr. Spangler said he wanted to donate a fine silver trophy to the Florida Rose Society for an annual trophy, the community winning this next year to hold it for a year and then pass it on the following year to the society winning it the next year. It is a nice trophy for the individual winning it because of the best exhibit there. Mr. Johnson also suggested there are so many tropical fruits grown down south if the committee wants to have an exhibit he would provide suitable cash prizes and trophies for exhibitors of tropical fruits.

I am most grateful for the wonderful spirit of co-operation manifested by Mr. Brooks and those from Miami. Miami really made a bid for the convention next season, but graciously stepped aside because we from Hollywood want you so badly. I also want to say that Tampa was com-

ing over here but they have also said they would be glad to come down and visit with us and postpone their effort to get the convention till later. Again we cordially invite you to come to Hollywood and be with us for the 1939 meeting.

I now introduce our friend and fellow member and one of the City Commissioners of Hollywood—Mr. C. L. Walsh:

Mr. Walsh: Fellow members, I bring you greetings as one of the City Commissioners of Hollywood to come next year to our little town and guarantee to do everything possible to make your stay a happy one. Hollywood is not strictly speaking a tourist town, we have vegetable interests, dairying interests and have also transplanted many trees from Winter Haven and the Ridge Section in the effort to see their growth in the Everglades and will be happy to show you what they do down there. I speak as a grower and Frank Stirling out there with us is the same way and is happy to meet with you all in Hollywood next year.

Next was introduced Mrs. Barbara Broome who has spent a lot of time working up the details of our next convention and will help the committee in any way possible, as a representative of the Convention Bureau of the Hollywood Beach Hotel.

Mrs. Broome: Mr. President, Ladies and Gentlemen, I am reminded of a little girl who was asked to make a speech to her Sunday School class on rally day. She was nervous and did not want to, but this is what she said: I am very small, as you can see, and you can't expect so much from me, but my Daddy said if I would speak he'd buy me a doll next week—So, I am saying this for myself too, as Assistant Convention Manager for the Hollywood Beach Hotel it gives me pleasure to invite you to come to Hollywood and to our hotel.

Frank Stirling, upon being introduced, said: Mr. Chairman, Floyd Wray, Barbara and Clyde have told you about the fine things down in Hollywood that you would enjoy and I am going to tell you that we need you down there to help us fellows solve our problems in the same manner we folks have come year after year to lend what little help we could to you folks in solving your problems. It is really a matter of asking your help rather than anything else, so won't you please come down to our section next spring and help us. I would just like to add this—about three months ago your President extended to me the courtesy of a most flattering introduction to a group of men in Miami and yesterday in this room he also extended me a courtesy in the act of withdrawing his plea for Miami as your next Convention city, and Mr. President, I just can't say anything more but thank you.

Mr. Brooks: I began to wonder if there wasn't a conspiracy to keep talking until no other city would have a chance to put a bid in. (Laughter.)

Mr. Geo. Spangler made the motion to accept Hollywood's invitation. The motion was seconded.

Mr. Brooks: Hollywood being the only city up for nomination and since you have heard from them I think the only thing to be done now is to put the matter to a vote. A standing vote was taken and passed unanimously. Motion unanimously carried.

Chairman: The Convention stands adjourned.

PROCEEDINGS

OF THE

THIRTEENTH ANNUAL MEETING

OF THE

FLORIDA ROSE SOCIETY

AND

THIRTEENTH ANNUAL EXHIBIT

OF THE

FLORIDA STATE ROSE SHOW

HELD AT

HAVEN HOTEL

WINTER HAVEN, FLORIDA, APRIL 13, 1938

FLORIDA ROSE SOCIETY

OFFICERS ELECT FOR 1939

PRESIDENT

G. H. Blackmon, Gainesville

VICE-PRESIDENT

Mrs. Leo Nash, Winter Haven

SECRETARY

Mrs. Donald McDonald, Winter Haven

TREASURER

Mrs. D. E. Cole, Lake Wales

1939 Meeting—Hollywood Beach Hotel

Hollywood, Florida

April 12, 1939

FOREWORD

The Thirteenth Annual Meeting of the Florida Rose Society and the Thirteenth Annual Florida State Rose Show were held in the Hotel Haven at Winter Haven on Wednesday, April 13, 1938. Thanks to the active cooperation of the Winter Haven Garden Club and the Gardenia Garden Club of Winter Haven, the Annual Meeting and Show proved to be a great success. The attendance at the Rose Society Meeting was good, there being more than 100 present. There was a very active interest as shown by interest in the papers and the talks presented and by the questions asked by the audience.

The Rose Show was a most creditable one and the many varieties exhibited attracted great attention and admiration. The arrangement was attractive and caused much favorable comment from the hundreds that visited the Show through Wednesday and Thursday. The background for the Exhibit was made up of masses of Florida Grown Gladioli furnished by the Bessemer Properties of Port Mayaca, the Pinellas Gladiolus, Inc., of Clearwater, and the Leesburg Bulb and Flower Company.

The Rose Show was staged under the direction of Mrs. Leo Nash and Mrs. Donald McDonald, presidents of the Winter Haven Garden Club and the Gardenia Garden Club and much credit is due them and the members of their clubs for the excellent showing made.

Following the meeting of the Rose Society, a pilgrimage was made to the N. E. Jordan Rose Gardens at Bartow where the members were delightfully received by Mr. and Mrs. Jordan and escorted through their extensive plantings. From there, the motorcade moved to the Cypress Gardens where the members were the guests of Mr. R. D. Pope and his associates at the Third Annual Gardenia Festival.

After the Festival, the ladies of the Rose Society and the Horticultural Society were entertained at a tea given in the parlors of the Hotel Haven by the members of the Gardenia Garden Club. It was a most delightful affair and much appreciated by the visitors.

That the rose has continued to command the love and respect it so justly deserves has been manifested in Florida from Pensacola to Key West by both amateur and commercial growers. More roses are being planted each year. In the large centers, some beautiful stock is being produced by the commercial growers and some are now experimenting in the production of flowers for northern shipment during the winter season.

This growth and development should be an incentive for the members of the Florida Rose Society to work toward a greater organization that will bring together the rose growers of Florida. The officers of the Florida Rose Society ask the members to give serious consideration to the many problems confronting the Society and to urge their friends who are interested in roses to join and to take an active part.

The next meeting of the Society will be held in the Hollywood Beach Hotel, Hollywood, on Wednesday, April 12, 1939. The people of Hollywood and Miami have already made their plantings for the Fourteenth Annual Florida Rose Show and expect to help to make the 1939 Meeting and Show the best that the Society has ever had.

ROSE VARIETIES FOR THE NOVICE AND A GOOD CONTROL FOR THRIP

MRS. H. R. WOODRUFF
Cocoa

Nearly every novice in rose growing asks the best varieties for Florida. In the hybrid teas, we of course plant some Radiance, but we are not Radiance enthusiasts, as we dislike the magenta color to which both the pink and red Radiance fade, and the lovely Charles Bell thrips abominably. We consider Editor McFarland, Betty Uprichard, President Hoover, Antoine Rivoire, Marie, Countess of Ilchester, Dainty Bess, and especially Etoile de Hollande much more beautiful, and with the exception of President Hoover, quite as sturdy as Radiance. Antaine Rivoire, particularly, hardly black spots at all. We still hear Radiance spoken of as the best rose for Florida, but Etoile de Holland is much more favored by members of the American Rose Society. President Hoover, of course, is a Pernetiana, and does not do so well the second year. To these ten roses should be added five of the fine old teas and Bengals which do particularly well in Florida, and live for many years—Marie von Houtte, cream, tinged pink; Duchess de Brabant, a lovely light pink, not at all washed out; Minnie Frances, the best of all, a rather deep pink, but without a trace of magenta, Mme. Lombard, pink always in bloom, but a better garden than cut flower, and the well known little red rose, Louis Philippe. People very often say that these roses do not last and are not cut flowers. Bobbink and Atkins thought enough of the Bengals, of which Louis Philippe is a fine member, to give them a full page in color last year. They are much more graceful than the often stiff hybrid teas. The other four are teas, and after three or four years old will often have a hundred blooms when a carefully nourished hybrid tea has two or three. I am hopeful that some member of this Society will try more of the fine old Bengals, which can be procured of Bobbink and Atkins. They are, however, quite expensive, and I have not tried them for that reason.

One rose grower in Cocoa has been more than successful with the tiny Rouletti and Tom Thumbs. They live through the summer quite well, and are very entrancing in tiny miniature vases. In the Cocoa Flower Show they were entered as specimen blooms in vases about 1½ inches high.

We only grew one Hybrid Perpetual—the lovely Frau Karl Druschki. It is by far the best of the whites, and is well worth replacing every year, as with us it never really does well the second year. Apparently it needs cold weather to harden its wood.

Before going to the fascinating subject of hybrid teas, I would like to call your attention to the fact that they are not remarkably long lived, even in the north. Well known rose firms sell them so cheaply, that even if they have to be treated as annuals, they are well worth while. Personally, I agree with Mrs. Poole that the very finest roses in Florida come from those bushes which have the flowers pulled through the summer and bloom early in the winter.

Whites are very disappointing to us. Kaiserin remains the best, though we very much like the delicately ethereal Caledonia. It thrips even worse than Kaiserin, and is said not to live over the first summer.

We don't believe that Golden Dawn is as successful here as it is in the North, but when thrip can be prevented, it makes a gloriously large pale yellow rose, with reflexed petals. We like Mrs. Pierre S. du Pont much better, though it doesn't last very long. It is a true golden yellow. The bi-color President Hoover and Talisman seem to be more yellow than anything else in this climate, bloom much more quickly than Radiance and have more flowers than any other bush the first year. All year residents can enjoy them during the summer, but it would be wiser for winter residents to give them away, rather than waste water on them during the summer. They

literally bloom continuously for ten months, then are almost worthless if they don't die entirely.

In the light shaded pinks, Antoine Rivoire, spoken of before, is by far the best, and Ophelia, which is a high centered type, is supposed to be a seedling of Antoine.

In the pink roses, Betty Uprichard is by far our favorite, though it must be remembered that we are not particularly fond of extremely double, heavy roses. Betty Uprichard has only about 17 petals. No two catalogues agree on its color, and Editor McFarland says its color is indescribable. It has a very high centered, exquisite bud. Not very good the second year. Willowmere is a golden pink, which was sent to us by mistake, and which is so lovely that we shall always have it. It blooms very early, and is not greatly troubled by thrip. Though Breeze Hill has never succeeded with Editor McFarland, it is listed by Bobbink and Atkins as the finest of *all* dark pink roses, and it does splendidly with us, though we do feel that at times its color is a slightly raw pink. Of course no rose has the same color for two consecutive weeks in Florida. The five-petaled Dainty Bess, an exquisite pink with wine stamens, is very lovely. The old Lady Alice Stanley thrips too much to be the success we had hoped. Bowles is better, though it has the same fault—an exquisite pink rose when perfect. It does better when given lots of ventilation. Of course Mrs. Chas. Bell and Pink Radiance belong in this pink list, also Columbia. Margaret McGredy belongs some place in this list, and though I can't give the color, I will say it is breath-takingly beautiful. It is nearer pink than anything else, and is usually listed as orange scarlet or carmine rose. It is quite double and cup shaped. It *does not* thrip very badly.

In reds, I think Etoile de Hollande is the best red, not only for Florida, but the best rose in the world. Every description of a red rose usually winds up with "as good as Etoile," "almost as good," and occasionally a feeble "better than Etoile." After writing this, I turned to the description of Bobbink & Atkins, and read "undoubtedly the finest red Rose in the world." Again, those of you who only like the very full petaled roses will not like Etoile de Hollande. It opens showing great golden stamens. I like McGredy's Scarlet in the very light rose reds. Every good nurseryman calls attention to the fact that it is misnamed as it is not scarlet at all. It is a great open loose rose much better in winter than spring. I would advise anyone to get only one or two bushes at first as opinions on this rose vary. E. G. Hill recalls Editor McFarland's description "We like every quality of the rose, but dislike every quality of the plant." But I still grow it, and always shall. I believe the Florida Experiment Station found that Chas. K. Douglas was the most profuse red bloomer in Florida. This 24 petaled flower is listed as "flaming scarlet, flushed velvety crimson." It is not one of the most beautiful red roses, but the most hardy of the hybrid teas, and is really lovely.

I have had no experience with the black roses, but Mr. H. W. Cannon, Jr., of Cocoa has been trying out several. Nigrette was very successful, but should be regarded as a Polyanthus. The only time I ever liked it was when I saw it used as a dark base in an arrangement of pink flowers. It really is almost black. Will Rogers had one exquisite bloom, then started to thrip, and has had no good blooms since. Ami Quinard was an outstanding failure—thin petaled on poor bushes. Rouge Mallerin has had some very beautiful blooms, though not so "black" as Will Rogers, and not nearly as much so as Nigrette.

I wanted to speak especially of Countess Vandal, as it seems to be one patented pink rose which is worth the extra cost. It is tall, beautiful and stately, and apparently not as shy a bloomer for us as it is in the north. We think it too heavy in the bud, but consider it the most beautiful of the fully opened flowers—we had one which measured 6½ inches across.

Though this paper is on varieties, I have mentioned thrip so often that I would like to suggest that anyone finding a remedy for it should report it to this Society. It is not pleasant to us to destroy a full crop of blooms. After many trials and errors, we adopted the following scheme, which was quite successful. Spray with a strong solution of Black Leaf Forty and soap on Monday evening *after* four o'clock. At noon the next day dust with Cold Smoke Dusting Powder, *not* rose dust, as that contains sulphur which must not be used in the middle of the day.

(Get plenty of dust on the ground.) Wednesday night spray with Black Leaf again, but before spraying wash the dust out of the roses, and dust the ground with the dusting powder. On Thursday, start over again! We weren't very successful in using either method alone, and suppose that one method was better when they were on the outside and another when they were farther inside. The dust on the ground is to kill those washed off. We don't like to use Black Leaf Forty so often, and cut it down to once a week as soon as possible. Thrip is not alone our problem, but is becoming increasingly troublesome in the north, and is spoken of more urgently in each Annual. We cannot use a poisoned bait for fear of poisoning our own and our neighbors' dogs.

As to varieties, we have about come to the conclusion that almost any variety which does well in most of the United States, in either the tea, hybrid tea, Noisette, Bengal, bracteata, Bourbon or perhaps Gigantea, will do well in Florida. We think that teas are very much overrated, with the exception of those named, as they ball and thrip so badly, but if they do well in the rest of the country, they will do well here. And we are very hopeful that this Society will make a research of the fine old varieties which originated in Charleston over a hundred years ago, and are now forgotten. Souvenir de la Malmaison always grew in the garden of Mr. H. W. Cannon, Sr., and can still be procured from Bobbink & Atkins. It would seem that other Bourbons can be grown here also, for those who can afford to buy them.

ROSE FUNDAMENTALS

MR. H. G. HASTINGS
Atlanta, Georgia

When we wrote Mr. Floyd that we intended to come to Winter Haven, he and your president, Mr. Ellis, took advantage of some one. We have not figured out whether it is you or me that the advantage was taken of.

The first thought was to have something to say about roses in Florida. Then it occurred to us that we were nearly 40 years removed from actual work with roses in Florida and our personal observations of roses within Florida during that nearly 40 years was little more than casual.

We told Mr. Floyd our fears as to competency. Next we knew was the arrival of a program with a subject assigned, "Rose Activities in Georgia." This was little help because Georgia had at least three distinct soil and climatic belts and we live in and carry on our rose growing operations in the northern belt of Georgia, where soil and climatic conditions are the most different from those of the peninsular part of Florida.

It rather seems to us, under the circumstances, that we can best serve you by limiting ourselves to fundamentals. After what we saw at the flower show in Ocala last April in the way of display of not only varieties of roses but annual and perennial flowers as well, we no longer feel competent to pass judgment on what can or what can not be successfully grown in this wonderful state of yours.

It is now nearly 40 years since our removal from Florida to Atlanta and at that time, in so far as roses, annuals or perennials were concerned, Florida was fully as much in the pioneer stage as was citrus and other fruits, as well as commercial vegetables, when we first came to Florida in 1883.

Annuals, biennials and perennials were practically unknown in the "80's" and early "90's." There were scattering bush roses in a few of the yards of the older places, mostly of the China or Bengal class such as Queen's Scarlet, Louis Philippe, etc. Climbers, usually running up over porches, were in greatest favor. The Marechal Niel, usually budded on Cherokee understock, was of course the favorite, followed by Chromatella or Cloth of Gold, Lamarque, Estella Pradel and a few others. Of course the Cherokee and McCartney on fences or as hedges were popular then as we presume they are today.

The Hybrid-Tea varieties as we know them

now rarely, if ever came into the Florida picture. Certain varieties of Teas, in addition to the China class previously referred to were about all that were planted or were offered by Florida or more particularly southern nurserymen such as Berckman's of Augusta, Georgia. Manetti was the almost universally used understock, de-eyeing had not begun to be practiced and the suckers from the understock came almost as rapidly as crab grass in the summer rainy season and unless kept under control constantly one had a Manetti Rose garden instead of the desired sorts.

Of the Tea varieties of those days, adapted to Florida and the Coastal Plain section of other Southern States our memory recalls a few, Isabella Sprunt, Marie Van Houtte, Bride, Bridesmaid, the White and Pink Mamon Cochet, Safrano, Bon Silene, Duchesse de Brabant (also known as Countess LeBarthe) and Papa Gontier. There was, as there is today, new sorts being offered year by year, but few reached general approval.

Incidentally and rather surprisingly the Hybrid Perpetual class had a fairly satisfactory representative in Paul Neyron which continues with us to this day, together with a later companion in white, Frau Karl Druschki, which seems to do wherever Paul Neyron does. Many of the Teas mentioned have passed out of most nurserymen's lists, but they had, and if obtainable, still have merit for Florida and the Coastal Plain area, while they have not the size and general development of flower size and shades, yet they are well adapted.

There is no question but what the Tea class of bush roses as a whole is best adapted to the lower south, including Florida. Next are those varieties of the Hybrid Tea class in which the Tea blood is dominant. Naturally this matter of dominancy of Tea blood or other possible factors establishing the adaptability of a variety can only come through actual growing test in a locality. In this we believe the nurseryman has at least a moral responsibility. He has first chance at testing adaptability and if a variety shows unusual lack of vigor or adaptability in his nursery he should not generally recommend it.

One cannot touch on the Hybrid Tea class without mentioning the Radiance family, Pink and Red Radiance and Mrs. Chas. Bell, which are the great standbys in Florida and the Coastal Plains. Our good friend, Dr. J. Horace McFarland, editor of the American Rose Annual, rather jokingly refers to the rose growers of the lower South as having Radiancitis." This is correct and we hope they never get over it until better varieties of as great or greater vigor come into our southern rose picture.

Please don't misunderstand. Dr. McFarland is not belittling or throwing off on the rose amateurs of the south. We have had many friendly discussions with him on this subject. We have contended, that with the list of varieties adapted to our territory as limited as it is, that the Radiance family is the "bread and butter of the rose amateur, who just loves roses but is not so much interested in the finer points.

We have further argued that we knew of nothing more discouraging to a person just starting to grow roses than to get a lot of highly touted varieties that passed off the scene the first season with little or no bloom. With a vigorous variety such as any of the Radiances even the beginner, with all the mistakes he or she is apt to make, is reasonably sure to have such measure of success as to lead them into continuing instead of throwing up their hands in disgust and quitting cold.

We agree fully with Dr. McFarland when he said to us that while he liked "bread and butter" Radiance yet he also liked to have a liberal amount of "dessert" in his rose diet. Of course we all like plenty of "dessert" along with our "bread and butter" varieties, but we must have the "bread and butter" first because many kinds of "desserts" are indigestible and don't agree with us.

We want to be absolutely fair with you. Your speaker is no rose expert in the technical sense of the word. Forty or more years ago he was trying to grow roses commercially in Florida to supply a hoped for trade. That trade did not exist except in a most limited way and that phase of our business was abandoned because it was seemingly ahead of the times. With the reestablishment of nursery work as a part of our business some 15 years ago the nursery and rose growing phase came under the direction of the

second generation and whatever of the really technical rose knowledge exists in our organization is in this second generation some of whom have met with and addressed your garden clubs.

This explanation is in a measure to forestall a possible barrage of technical rose questions that we know we cannot satisfactorily answer and which we are reasonably certain that Dr. Hume, who follows me on this program can. He is interested in roses, has been here for these formative years in the Florida rose growing game and knows at least some of the answers.

* * *

Based on our Georgia rose growing experience in a sandy clay loam soil, plus what our Florida and Coastal Plains friends most largely send for among the Teas and Hybrid Teas, a limited list of recommended varieties may not be out of place. This is by no means saying that they will all do well in all of Florida and the Coastal Plains but rather a list to be checked against based on local experience if any one has grown the variety in your neighborhood. With us the following have shown the greatest vigor and given the most satisfaction when budded on a special selection we made of Multiflora stock.

The White and Pink Mamon Cochet of the Teas are obtainable from almost any southern nursery offering roses. The same is true of Alex. Hill Gray, lemon color, and Lady Hillingdon, saffron yellow, both Teas. Among the newer sorts, mostly Hybrid Teas, we prefer the following for the lower south; Caledonia, pure white; Condesa De Sastago, copper and yellow, and especially good with us; Dainty Bess, large single flowers of soft rose pink; Edith Nellie Perkins, coppery orange pink; Editor McFarland, pink; Elizabeth of York, cerise pink; Etoile de Hollande, brilliant red; Golden Dawn, yellow, a sort of bush Marechal Niel; Picture, pink and especially good; and Sister Therese, yellow.

To this list should, in our opinion, be added an old variety of Hybrid Perpetual that, so far as American nurseries are concerned almost dropped out of sight and why is a mystery to us at least, unless it was the outlandishly long name it was burdened with—that name is Gloire De Chedane - Guinoisseau. It is a rich brilliant red, a counterpart of Frau Karl Druschki in everything but color. We rediscovered it, if that is the proper term, in the Porterfield test grounds of the American Rose Society near Macon, Georgia, and we have never seen a finer red rose of its class. It was being grown in a border, the plants being alternated with Druschki and it was a sight to warm every rose lover's heart. We have seen some wonderfully fine Druschkis in Florida and apparently Guinoisseau does well wherever Druschki does. While both these H. P.'s bloom mostly in spring, there is more or less bloom throughout summer and fall and we believe it will make a fine winter bloomer in peninsular Florida.

Of what may be termed the more standard varieties our choice among the pink sorts of Hybrid Teas is Betty Uprichard, Dame Edith Helen, Isobel, Madame Butterfly, Margaret McGredy, Rapture and Una Wallace; of the two-toned sorts, Cuba, President Hoover and Talisman—President Hoover particularly has shown a very wide range of adaptability.

Of the red sorts, our preference for the lower South are Chas. K. Douglas, His Majesty, McGredy's Scarlet, National Emblem and Red Letter Day. Our top preference in reds, however, is the Etoile de Hollande, previously referred to. Of the white varieties of H. T.'s we like Abol, Double White Killarney, Edel and the old Kaiserin Auguste Victoria. To the white of course should be added that grand white free blooming Frau Karl Druschki. We are also inclined to add Innocence, a pure white single rose of immense diameter that was the second best rose in the 1936 Atlanta Rose Show.

Of the yellow varieties, in addition to the Teas already mentioned, Alex. Hill Gray and Lady Hillingdon, we are inclined to favor Golden Ophelia, Joanna Hill, Luxembourg, Mme. Jenny Guillemot, Mrs. Erskine Thom, Mrs. Pierre S. Dupont and Sunburst.

These recommendations are based, first on our own experience in growing about one hundred thousand plants each year some 5 miles south of Atlanta; second, frequent trips to Porterfield, near Macon, Georgia, a test ground of the American Rose Society and just on the edge of the drop to strictly Coastal Plain conditions; third, viewing most of these varieties as exhibited in the

various Rose and flower shows in lower south territory, such as Savannah, Macon, Columbus and Thomasville, Georgia.

This latter show, Thomasville, we consider especially valuable in this respect because, when we first started going down there many years ago, it was, for all practical purposes, a Radiance Show. We got ourselves in hot water, so to speak, when we said very undiplomatically in answer to a question as to how we liked the Thomasville Rose Show, that it was a wonderfully fine Radiance Show, but it could hardly class as a real Rose Show. After the first resentment was over, they took the criticism in good part and any of the Thomasville shows of the last two or three years will show a full exhibit of practically all of the better varieties that have shown reasonable adaptability to that section. Incidentally, if you can make it convenient, go to the Thomasville Rose Show sometime, it will be well worthwhile if you love roses. The Thomasville section is better comparable to Florida conditions than almost anwhere we know of in the lower south outside of Florida and we are very certain that you can learn a lot about not only roses but many other flowers. While not certain, I think the date of the 1938 Thomasville Show is April 29.

Fortunately, the same day that we started this paper, we received one of our frequent letters from Dr. McFarland. We keep up a sort of running correspondence touching on almost every current subject, but much of it is devoted to roses. Dr. McFarland, in our opinion, leads the rose procession in this country. He is in frequent contact with all the leading rosarians both here and abroad and he gets impatient with us sometimes when he thinks we don't step along fast enough in the rose procession.

Both in correspondence and by word of mouth, we have at times called the Radiance the "roughnecks" of the rose family. We have contended that with the ability of the Radiances to grow and bloom under almost every sort of condition here in the south, where other varieties are so frequently a failure, it would be a crime almost to "soft pedal" advocacy of planting the Radiance roses freely.

In writing Dr. McFarland recently we called his attention to the answer that great breeder of pure bred collie dogs, Terhune, gave, when asked what kind of a dog a boy should have first and the reply was "a mongrel." In reply Dr. McFarland says, "You mustn't misunderstand me about the Radiance rose. I am one of its warmest admirers and cherished until he died at the age of 96, a friendship for John Cook, who did it. But it isn't the only rose and those who submit to what I call 'Radiancitis' are simply rose lazy. Other roses are developing which are just as universal in appeal and just as easy to grow, but it does take a little experimentation to discover them.

"More than that, there never was as much attention being paid before toward the getting of roses that are in themselves disease-resistant. The idea is strongly developed in the 1938 Annual and I am hearing from it all around. We must have roses that can take it and that are adaptable to the widest range of conditions. We are getting them." We certainly hope Dr. McFarland is correct in his statement that "we are getting them" because they are needed to bring into rose growing for pleasure the vast, almost untouched field of potential rose growers.

There is, in some parts of the north, a limited number of extreme rose enthusiasts, who want to treat the rose sort of as an annual; that is, buy budded two year old plants each spring, bloom them through summer and fall and then dig them up and throw them away. In this way they get away from problems of adaptability, hardiness or resistance to unfavorable conditions, diseases that do not show up until the second and third years.

We cannot subscribe to such a theory or fad. The rose is, or should be at least, semi-permanent. Further, there are few people in a financial position to replace their rose plantings each season. If we may detour into the sentimental or near sentimental, such a short period does not enable the grower to get well enough acquainted with the plants to learn to love them and no amateur grower of roses or other flowers can fully succeed unless they love the plants and bestow loving care on them.

As an ex-Floridian rose grower, it is our thought that one of the obstacles to full success in Florida with roses, once the question of adaptability is settled, is that of giving your rose plants a sufficient period of rest from active growth. Roses need rest periods, if they are to be long lived. We do not know the answer, unless it is to let up on frequent feeding or fertilizing during the latter part of summer and cease pruning or severe cutting by July 1.

Naturally you cannot get the full degree of dormancy that roses get in the north or even in the Atlanta area but a period of dormancy or near dormancy is needed. This is one of your problems. Possibly Dr. Hume, with his large corps of assistants engaged in research work, can help in this.

Another important thought or opinion is that all bush roses that are kept rather closely trimmed should be well mulched wtih some dark colored substance so that the bright sunlight and heat will not be refracted up to the under side of the rose leaves. This under side is far more tender than the upper side which is supposed to take the sun. Well pulverized muck, when available, is fine for this purpose. In commercial form you have the Florida Humus prepared over at Zellwood, and the German or Swedish packs of Peat Moss. These are all good and they certainly do help take care of the under side of the rose leaves and this all helps toward healthier plants, larger and more perfect bloom.

Will you permit a word of advice from the commercial side, the nurserymaan's side. Naturally you want to succeed. The advice is, don't buy roses from any person or firm that you don't know or at least you know has a reputation for reliability and has sustained it through a reasonable period and who will stand back of the roses or other goods they sell.

In recent years this whole country has been flooded with cheap roses. Many smaller nurserymen have bought them and resold. The department stores and the 5 and 10 cent stores take their fling at it most every year. Most of this supply comes from Texas. Much of it is produced under conditions that almost insures dissatisfaction. Some of these "rose bargains" are the exhausted rose plants from greenhouse forcing.

Please do not misunderstand. There are some just as good rose growers in Texas and California as there are in Florida, Georgia, Pennsylvania or Illinois. However, the stock from such growers does not go out to the public via department store or 5 and 10.

The conscientious nurseryman will not charge you any exorbitant price although it may sometimes seem so in comparison wtih some of the "alleged bargians." It's the old, old story, first cost or last cost and the price you pay for your rose plants is a very small item in comparison with all the other expense necessary to bring your roses to a full measure of success. Dealing with folks you know, or at least know of by reputation is the best insurance you can get, first as to healthy plants and second as to trueness to name. Can you afford to take unnecessary risks at the very start?

ROSE TIPS FOR THE SOUTH

DONALD M. HASTINGS
Atlanta, Georgia

All roses respond generally to provisions for good loamy soil, sunlight, perfect drainage, sufficient available food, and a reasonable moisture supply, particularly during the growing season when the demand upon the plant is at the peak, in sustaining heavy growth necessary for successful bloom production.

Other factors, though, must be given careful attention for successful roses not only here in the South, but elsewhere as well. Varietal adaptation, proper understocks, soil chemistry, judicious pruning, and spraying, are vital points about which round tables of discussion revolve and resolve and to which painstaking months and years of research are devoted.

Generally speaking the older type teas, hybrid teas and hybrid perpetuals, together with their offspring, constitute our best varieties from which to choose our bush roses. The Pernetianas seem to have had an inherent weakness and susceptibility to disease that rendered them short lived here in the South, but fortunately bud selection in producing succeeding generations is overcoming this drawback to a great extent, and is coupled with the elimination of many undesirable varieties that should never have been introduced at all. We shall soon be rewarded with strong plants with gorgeous color combinations heretofore unobtainable.

There is a tremendously wholehearted and lustily honest difference of opinion as to proper rose understocks with each type having its champion in each locality, but frankly the most important consideration is *how the roses are handled from the growing field to the buyer's garden!*

Because a choice rose is budded on a highly reputed understock does not insure success, but of course it is a highly important factor in its ultimate satisfactory behavior. *Rosa odorata* (Texas wax) and *R. laevigata* (Cherokee) in Florida and along the Gulf Coast; Texas wax in Texas; and Ragged Robin (*Gloire des rosamanes*) in Southern California, have long been peculiarly adaptable to their respective regions and for their favorable local varieties, but the most universally acclimated, thrifty, long lived, and satisfactory understock from West to East, and from North to South, is *Rosa multiflora* (japonica), upon which the vast majority of American roses for outdoor culture are budded, indicating that it is most generally successful for most varieties offered for our gardens.

The grand difference in opinion about this latter statement is probably due to local experiences with a more or less limited assortment of varieties, which naturally biases an opinion toward one or another type.

Worthwhile conclusions should be arrived at only after observation of trials in many localities, covering a wide range of varieties, and for at least several years of tests.

And now that nurserymen are selecting unusually desirable *strains* of the particular understock they use, the confusion grows greater, than less, with the necessity for more confidence in the integrity of the nurseryman to offer the best to us.

Soil chemistry is pushing to more prominence in rose growing to the extent of our supplying not only nitrogen, phosphoric acid, and potash, long known soil deficients, but the lesser elements of iodine, boron, manganese, and others that may be vital factors of success. And, too, recent experiments tend to show a slightly acid soil to be most favorable to good growth and subsequent bloom production in many sections (this after all we've heard about limestone soils and lovely roses being synonomous!).

Another controversial subject in rose circles is that of pruning. Shall it be severe or moderate? The answer depends, of course, upon the object in view and the type rose under consideration. Always prune "teas" very moderately the same as shrub roses, but prune "hybrid teas" and "hybrid perpetuals" severely for exhibition specimens and moderately for more but less outstanding indi-

vidual blooms. Supplemental pruning is always quite moderate, for the plants need their full leaf surface to manufacture vigor for succeeding seasons.

Spraying is rapidly becoming an art due to the necessity of timely preventive action, with frequency, and thoroughness of application. Triogen, Bordeaux Mixture, lime-sulphur, Massey Dust, basic copper sulphate, and red copper oxide are popular materials that have been rather successfully used in preventing and to a lesser extent in controlling mildew, black spot, anthracnose and other diseases prevalent in most sections of the country. The secret in the use of any of them is in having an efficient sprayer or duster, and having the will to use it frequently and thoroughly.

But the greater of these is the *Love* we give to our roses.

MINUTES OF 1938 MEETING

The 13th annual meeting of the Rose Society of Florida was held on the mezzanine floor at the Haven Hotel in Winter Park, Florida, on April 13th, 1938.

The meeting was called to order by the President, Mr. R. H. Ellis, who then called on Rev. Harcourt Johnson for the invocation.

The first item on the program was the President's address, then Mr. H. G. Hastings gave an address on "Rose Activities in Georgia." After Mr. Hastings' address a round table discussion took place. A number of questions were answered and helpful hints were suggested. Mrs. A. M. Tilden then read a paper by Mrs. H. R. Woodruff of Cocoa, Fla. The business session then took place. Mr. Floyd of the Nominating Committee proposed the following names for officers:

Mr. G. H. Blackmon, Gainesville, Fla., President.

Mrs. Leo Nash, Winter Haven, Fla., Vice-President.

Mrs. D. E. Cole, Lake Wales, Fla., Treasurer.

Mrs. Donald McDonald, Winter Haven, Fla., Secretary.

These officers were unanimously elected by the Rose Society members.

Mr. Floyd announced the pilgrimage that would follow the business meeting. Mr. Nye Jordan's Rose Garden was opened, and all members of the Rose Society were admitted free to the Florida Cypress Gardens. A representative of Sheriff Chase of Polk County led the procession.

The newly elected President, Mr. G. H. Blackmon, then gave a few fitting remarks, asking all members to give him their complete support.

The meeting was then adjourned.

MRS. DONALD MCDONALD,
Sec'y of Florida Rose Society.